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अनुसंधान

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ANUSANDHAN
A SCIENCE TECHNOLOGY & MANAGEMENT JOURNALOF RNTU

From the Desk of Patron

Dear Friends

With declining Corona-graph and climbing vaccination drive in the country, the higher education sector looks ready to bounce back or should we say bounce forward. However challenges are many on the road ahead. On one hand, new normals in higher education post covid-19, demand spate of micro level corrections, marginalizing physical and social dimensions, and on the other side, New Education Policy-20 (NEP) has brought in sweeping reforms in the total outlook, methodology and framework in higher education sector demanding wide spread action. For the new journey of Higher Education Institutions (HEIs), technology occupies the pilot's seat in the cockpit. On the copilot's seat Indian values are firmly harnessed. The destination is off course quality (Excellence in Research and Academics), quantity (GER and Accessibility) and employability (Skill and Knowledge). Improvement in employability is being ensured through many structural changes like making programmes modular with option of entry exit at several places, introducing vocational education compatible and aligned to formal education and NSQF; and emphasis on skill in curriculum with internship and apprenticeship embedded in an effective way. Vocational education, autonomy to institutions and liberal and multidisciplinary approach are likely to take GER certainly beyond 50% by 2030 as envisaged in the NEP. For improving academics quality also, lots of initiatives have been listed in the policy on which action has already been initiated.

Now what happens to the research. It is well known fact that quality in education, which is main aim of the entire effort, cannot be brought about without excellence in research. Government's emphasis on special support to 100 institutions, to try get top world ranking, internationalization to associate top Indian institutions with top universities of the world and establishment of NRF and RFRF are clear indications for visionary institutions to see writing on the wall. The NEP talks of three types of institutions. First research intensive, second research and teaching type and third only teaching and academic degree giving type. If a teacher has to make a carrier in education he/she has to earn enough credits in research even if he/she is working in only teaching type institute. So obviously research is going to take navigator's seat in the new journey of HEIs irrespective of type of the institute.

In the new environment there are some confusion, some dichotomous options and some contradictory situations. For an institution to become autonomous which obviously is the aim of any institution, it has to score A+ in the NAAC accreditation which is not much possible without very good research which has over 25% weightage. While whole emphasis is on quality, the quality has only 30% weightage in NAAC whereas quantity has 70%. Even in quantity it counts only numbers i.e. so many patents, so many papers etc, quality of number is not so significant at

present. The NEP lays emphasis on regional languages and Indian value system but most of the journals are of foreign origin. Hardly any journals are in Indian languages in professional areas like technology, management etc. However it is expected that in time to come these anomalies will be taken care by the system.

Publication of this issue of **ANUSANDHAN** coincides with a joyous occasion when we are celebrating 75th year of our independence. At this juncture we all are proud of achievements that India has made, despite very difficult time that whole world has passed through. Research has helped in several ways to meet the challenges posed by the pandemic. Our scientists found vaccine for covid-19 within a year. The health and education sectors saw path breaking research and innovations to overcome challenges posed by the pandemic. In the difficult time the phrase – **'Research must go on',** was the guiding light. That is how India has jumped to second position in Global Manufacturing Index and jumped 32 positions to come in first 50 nations for the first time in Global Innovation Index.

This issue of **ANUSANDHAN** coming out on dot, containing many thought provoking papers, exhibits zeal and commitment of our subscribers and editorial team. The first papers in this issue are written by very experienced experts from the real field, bringing out quite vital aspects in respective fields. This includes a paper by Mr. AM Gupta former ED, BHEL who has given project details bringing out proud contribution of designers and engineers of BHEL in designing and installing largest pump for lift irrigation scheme in Telangana - A real example of Atma Nirbhar Bharat. Mr. Deepak Joshi who has deep know how in Hydel Power Projects has given intricate details of designing switchyard in his paper. How Critical problems in hydro power units can be solved with a research full approach has been nicely brought out in yet another article by Mr. T Mulchandani who has vast experience in the field. An over view of hydra electric development by Dr. SR Awasthi can be used as most comprehensive document by researchers as a good reference material. All other articles also in this issue I am sure, will provide with lot of excellent food for thought, and motivate for further research.

On behalf, of entire **ANUSANDHAN** family. I convey warm greetings for the **'Azadi Ka Amrit Mahotsav'** being celebrated on the occasion of 75th Independence Day, and wish all our readers a very research full joyous time ahead.

Prof. Vijay Kant Verma
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In This Issue

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BHEL's in-house Development of the largest pumps for World's largest Kaleshwaram Lift Irrigation Scheme in Telangana

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Abstract - *World's largest Lift Irrigation Scheme is being executed in the water starved state of Telangana. The features of this multi-purpose irrigation project on Godavari River are described which will meet the irrigation and drinking water needs of 20 of the 31 districts of Telangana. The links, lifts, reservoirs (existing and new) are briefly mentioned in the paper to give an overview. The paper explains the success story of BHEL who has passed successfully the phases of design, model testing and manufacturing of the highest capacity synchronous motor driven pumps with in-house experience and technology.*

Keywords: Largest lift irrigation project, largest pump-motors.

I. INTRODUCTION

In 2015, NASA's satellite data revealed that globally speaking, 21 of the 37 large aquifers are severely water-stressed. With growing populations, and increased demands from agriculture and industry, researchers indicated that this crisis is only likely to worsen. In India, at the time of Independence, there were about 15 lakh water bodies spread across rural India. However, now over 12 lakhs have been either encroached or polluted. The impact is being felt now with about 72% of aquifers drying up. The world is heading towards severe disaster and water may emerge as the main cause for the triggering of the World War-III.

India is taking initiatives to manage the need of water by creating the Ministry of Water Resources, River Development and Ganga Rejuvenation for formulation and administration of rules and regulations relating to the development and regulation of the water resources in India [1-2]. The Government of India has launched the **Jal Jeevan Mission** on August 15, 2019, to provide tap water supply to every rural home by 2024. Some initiatives are taken in some states by linking of the rivers within a state or interstate.

The Godavari River flows from Maharashtra into the northern Telangana. As per the award of *Godavari River Disputes Tribunal*, Telangana has an allocation of *900+ TMC* of water in the Godavari River. However, Telangana is barely able to use 300 TMC. The reason behind is that inflows into existing major and medium irrigation projects in Telangana from Maharashtra are very poor. This is due to the construction of several dams, barrages and lift irrigation projects on river Godavari in the Maharashtra. Further, Godavari River flows at a lower elevation (+100 m Above sea level) whereas Telangana regions are at a higher elevation (+300 m to +590 m above sea level). Gravity based projects are not a feasible option and lift based projects remain the only way out. Such a situation compelled Telangana to take-up such a huge lift irrigation project to fulfill water demand of 20 water starved districts.

A great initiative was taken in Telangana where world's largest lift irrigation project is under execution to cater the needs of irrigation and drinking water. Telangana has started harnessing the water at the confluence of two rivers with Godavari by constructing a barrage at Medigadda in Jayashankar Bhupalpally district and reverse pump the water into the main Godavari River and divert it through multi-stage lifts and pumps into a huge and complex system of reservoirs, water tunnels, pipelines and canals.

(a) Unique Records

The project records the world's longest water tunnels, aqueducts, underground surge pools, and largest capacity pumps, all indigenous.

(b) Major project data

Lifts	618 m by 20 nos. lifts powered from 19 pump houses
Links	7 nos.
Power requirement	7152 MW
Incoming grid supply voltage	33 kV to 400 kV (stepped down to suit the motor voltage)
Electricity suppliers	Telangana State Northern Power Distribution Company Limited.
Water flow system	Total length = 1832 km (1531 km gravity canals, 203 km tunnel and 98 km pressure/delivery mains).
Irrigation area	45 Lakh acres
Drinking water/industries	Hyderabad, Secunderabad, several towns, and villages
Project cost	Rs. 80,000 Cr. (Likely escalate to over Rs. 1 Lakh Cr.)

II. LAYOUT OF KALESHWARAM LIS AND ITS MAJOR COMPONENTS

The project comprises of several existing balancing reservoirs, new reservoirs, canals, tunnels and seven links for distribution of water. The overall Scheme of the Kaleshwaram project is shown in Figure 1.

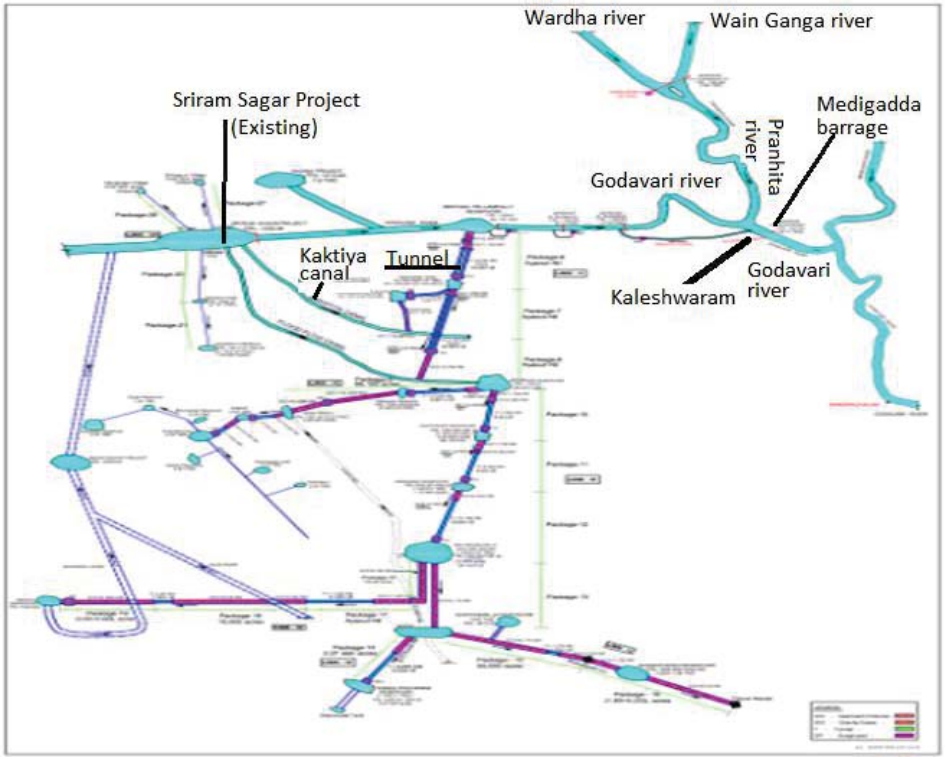

Fig. 1 Layout of Kaleshwaram Lift Irrigation Project [3]

Kaleshwaram Lift Irrigation Project starts at the confluence of rivers *Pranhita* and *Godavari* at Kaleshwaram village in Jayashankar Bhupalipalli district. Pranahita river in itself is a confluence of various other smaller tributaries mainly, Wardha, Penganga, and Wainganga Rivers. It is estimated that Pranahita river has an annual average flow of 280 TMC. It remains untapped as its course is principally through the dense forests and other ecologically sensitive zones such as wild life sanctuaries. Its layout is shown in Figure 2.

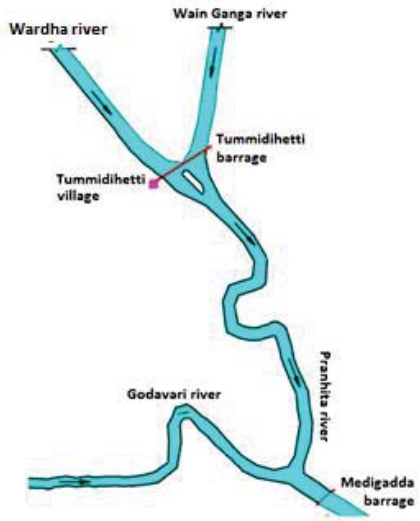

Fig. 2 Rivers Pranhita, its tributaries, and Godavari [3]

In 2016, Telangana and Maharashtra governments signed MoU in which a new barrage at Medigadda and a lift at Kannepalli Village lift water for the project was agreed. The whole project was designed with adequate barrages and reservoirs aided by pumps and lifts at appropriate places under the name "***Kaleshwaram Lift Irrigation Project***".

III. LINKS AND WATER USAGE

Kaleshwaram Project is divided into 7 links and 28 packages covering about 500 kms of 13 districts and a canal network of about 1800 kms. The project aims to utilize a total of **240 TMC** of water from following resources:

Table 1: Planned Break-up of drinking water from Kaleshwaram Project.

Source	Water quantity
Medigadda Barrage	195 TMC
Sripada Yellampalli Project	20 TMC
Groundwater	25 TMC

The break-up of the usage of 240 TMC water is given in Table 2.

Table 2: Planned Break-up of usage of water from Kaleshwaram Project.

Usage	Annual Quantity of water
Irrigation	169 TMC
Water for Hyderabad	30 TMC
Drinking water for villages along the project	10 TMC
Industries	16 TMC

Note: 12 TMC water is estimated evaporation losses

The links for water flow through canal/tunnels and Irrigated Command Area/Ayacut (Acres) are given in Table 3.

Table 3: Links in the Kaleshwaram Project

Link No.	Linking between	Command Area/ Ayacut (Acres)
Link-I	Medigadda Barrage on Godavari River to Sripada Yellampally Project	30,000
Link-II	Sripada Yellampally Project to Mid Manair Dam	
Link-III	Mid Manair Dam to Upper Manair Reservoir	86,150
Link-IV	Mid Manair Dam to Konda Pochamma Reservoir	5,95,754
Link-V	Anicut to Chityala	2,43,500
Link-VI	Sri Komaravelly Mallana Sagar to Singur Dam	2,80,296
Link-VII	SRSP Foreshore to Nizam Sagar Canals and to Dilwapur and Hangarga village for Nirmal and Mudhole Constituency	5,90,000

NOTE: New Ayacut = 18,25,700 Acres, apart from 18,75,000 Acres (Stabilization of existing ayacut)

Gravity Canals & Tunnels for distribution

Gravity Canal	1531 kms
Gravity Tunnel	203 kms
Pressure Mains/ Delivery Mains	98 kms

The water is to be reverse pumped from the confluence point of Godavari and Pranhita Rivers to Sripada Yellampally Project by providing 3 barrages (Medigadda, Annaram and Sundilla) and 3 lifts shown in Figure 3.

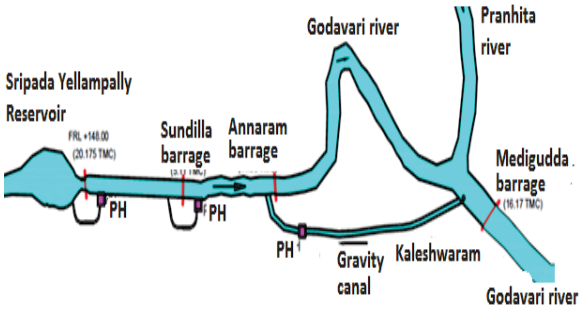

Fig. 3 Layout of Link-I of the Project [3].

At present, lifts are being constructed to lift 2 TMC (56,63,36,93,184 liters) of water per day from Medigadda to the backwaters of Annaram barrage and then to Sundilla barrage. Finally, the water if pumped from Sundilla to Sripada Yellampally Project. The civil works under execution are to lift 3 TMC per day but presently the pumps are being erected to lift only 2 TMC. In future, if need be, only pumps would need to be installed to increase capacity to 3 TMC.

Major civil contractors associated with Kaleshwaram LIS are M/s MEIL (Megha Engineering & Infrastructure Ltd), M/s NEC (Navayuga engineering company Ltd), M/s Prathima Infrastructure Ltd, and M/s KNR Constructions Ltd.

Fig. 4 Overview of the Medigadda pump house [4].

Fig. 5 Delivery Reservoir: Package 6

IV. Development of Highest Capacity Pumps in India

BHEL is the leading public sector Company for the design, manufacturing, supply, installation, commissioning, and subsequent services of the wide range of heavy electrical equipments which include generation, transmission and distribution systems of hydro, thermal and nuclear power projects. It is equipped with the best laboratory in India for testing of the models of hydro machinery. They have supplied and commissioned hydro power projects in India and abroad with generating capacity up to 200 MW. As far as reversible units for pumped storage projects are concerned, BHEL has supplied pumps up to 220 MW but in some foreign collaboration.

The first large capacity pumps quoted by BHEL were 4x18 MW for Srisailam Lift Irrigation Project. It was challenging to win the customer's confidence for design and manufacturing based on in-house design experience and manufacturing technology. The model testing of the pump impeller was carried out in BHEL's Hydro Machinery Laboratory in Bhopal which was witnessed by Irrigation Department, Government of Andhra Pradesh and APSEB. The hydraulic design of pump was reviewed by IIT Delhi. Finally, the customer was convinced and placed an order on BHEL. This impeller profile was modified from time to time for other ratings of the pumps using CFD (Computational Fluid Dynamics).

The Pranhita pumping projects in Kaleshwaram LIS are under various stages of supply, installation, commissioning, and operation. BHEL has a major contribution in the prestigious Kaleshwaram Lift Irrigation Scheme. All high rating Pump-Motor sets along with control systems are in the scope of BHEL supply. BHEL scope under these packages are Pump-Motor & its Auxiliaries, bus-bars, discharge valve, Static Frequency Converters for starting the synchronous motor, SCADA & Busducts. BHEL has supplied and commissioned 22 Pump-Motor sets for 4 Pumping stations to match with the site requirement. Another 23 Pump-Motor sets for 5 Pump houses are under supply. The status of pump-motors is given in Table 4.

Table 4: Large capacity Pumps ordered on BHEL

S.No.	Project	Capacity	Speed (RPM)	Head (M)	Discharge (Cumecs)	Remarks
1	Pranhita Package-6	7x116 MW	200	105.45	7x90	7 nos. commissioned
2	Pranhita Package-8	7x139 MW	214.3	119	7x90	7 nos. commissioned
3	Pranhita Package-10	4x106 MW	200	101.2	4x85	4 nos. commissioned
4	Pranhita Package-11	4x134.4 MW	214.3	122	4x85	4 nos. commissioned
5	Link-2 Package-1	5x145 MW	250	148	5x72	Supply under progress
6	Link-2 Package-2	4x138 MW	200	108	4x90	Supply under progress
7	Link-4 Package-1	4x125 MW	200	116	4x84	Supply under progress
8	Link-4 Package-2	6x125 MW	375	168	6x55.5	Supply under progress
9	Link-4 Package-4	4x81.5 MW	176.7	74	4x83.25	Supply under progress

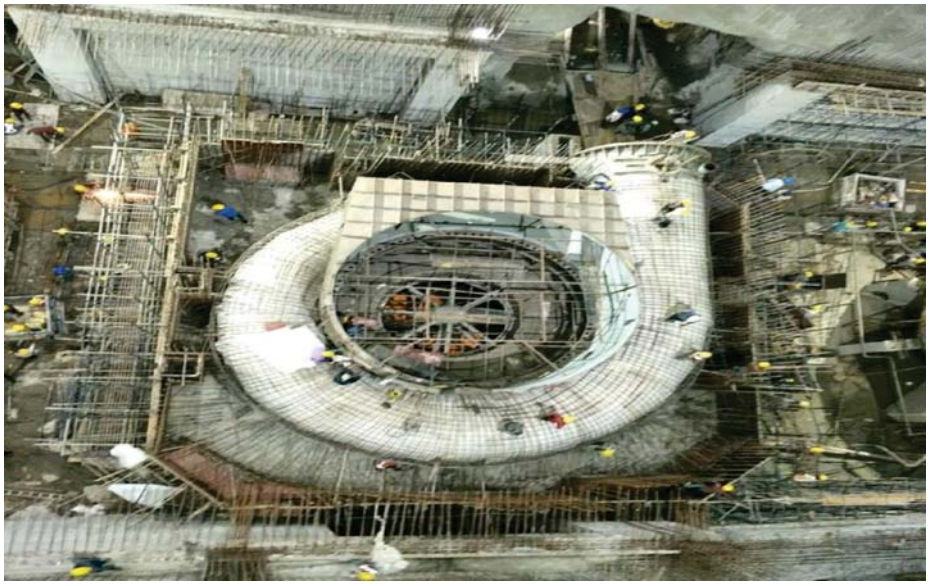

Fig. 6 Spiral Casing of 134.4 MW Pumps under installation

Table 5: Large capacity Motors ordered on BHEL

S.No.	Project	Capacity	Speed (RPM)	Motor Voltage (kV)	Remarks
1	Pranhita Package-6	7x116 MW	200	11	7 nos. commissioned
2	Pranhita Package-8	7x139 MW	214.3	13.8	7 nos. commissioned
3	Pranhita Package-10	4x106 MW	200	11	4 nos. commissioned
4	Pranhita Package-11	4x134.4 MW	214.3	13.8	4 nos. commissioned
5	Link-2 Package-1	5x145 MW	250	11	Supply under progress
6	Link-2 Package-2	4x138 MW	200	11	Supply under progress
7	Link-4 Package-1	4x125 MW	200	11	Supply under progress
8	Link-4 Package-2	6x125 MW	375	11	Supply under progress
9	Link-4 Package-4	4x81.5 MW	176.7	11	Supply under progress

Fig. 7 Lowering of 200 t Stator Assembly of 116 MW Pump

Fig. 8 Lowering of Rotor Assembly of 125 MW Pump

Fig. 9 Pump House equipped with 4x134.4 MW Pumps

Kaleshwaram LIS is the glaring example as what could happen if the customer is not only satisfied but also delighted. BHEL has won the customer's confidence which has resulted in bulk order for the supply of total pump house equipments to BHEL for Palamaru Ranga Reddi LIS. This project is designed to lift water in five stages from the Srisailam Reservoir near Yellur village in Nagarkurnool district to the proposed KP Laxmi devipally Reservoir (+670.00 M) near Shadnagar. The project is envisaged to create irrigation potential in upland areas of Nagarkurnool, Mahabubnagar, Vikarabad, Narayanapet, Rangareddy and Nalgonda districts, for an ayacut of 10 lakh acres and drinking watersupply to villages, GHMC and industries. The details of orders for supply of pump-house equipments / machinery are given in Table 6.

Table 6: BHEL to supply for Palamuru Ranga Reddi LIS

Project Stage	Pump-motor capacity
Palamuru Stage-I	4x145 MW
Palamuru Stage-II	5x145 MW
Palamuru Stage-III	5x145 MW
Palamuru Stage-IV	3x145 MW
TOTAL	17x145 = 2465 MW

V. Conclusion

The project will enable farmers in Telangana to reap multiple crops with a year-round supply of water wherein earlier they were dependent on rains. Thus, they would get rid of frequent crop failures. Several districts would come out of the sufferings to water scarcity and also the ground water contaminated with fluoride. Apart from irrigation, a major component of the project is the supply of drinking water to several towns and villages and also to twin cities of Hyderabad and Secunderabad. The Kaleshwaram LIS is progressing fast and the farmers have already started cultivating multiple crops and situation on supply of water for drinking and industries is easing down.

It has been a great achievement for the nation that BHEL has successfully emerged and established as the designer, manufacturer and erector and commissioning of the pump houses equipped with largest capacity synchronous motor driven pumps in India. It has resulted with the award of huge order of 17 pump-motors and associated equipments. Indigenous development of largest capacity synchronous motor driven pumps with in-house efforts is an exemplary step towards ATMANIRBHAR BHARAT which has already saved imports of equipments /machinery worth hundreds of crores of Rupees.

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Considerations and Challenges in Switchyard Planning of Hydel Power Projects

Deepak Joshi
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Abstract- *In this article, we are discussing planning of switchyards of hydel power stations. The - switchyards are planned depending upon number of units, number of feeders and the voltage level. In case of thermal plants, normally plain area is available near power house building. It is just like to make a drawing on clean black board. We can plan the switchyards as per the established practice of the generating company. However, in the case of hydel power stations, the project is tailor-made. Its layout varies from project site to site. The switchyard, in some cases, may have to be planned quite away from power station depending upon the availability of plain land. Sometimes, due to hard rocks, it is quite costly to create plain area for switchyards. Therefore, the switchyard may have to be planned quite away from power house building. Generator Transformers are generally located near to the power house building from where H.V. feeders are taken to switchyard by installing suitable towers or sometimes suitable anchoring in the dam body.*

Keywords: Switchyard, Switchyard planning; high level, normal level, step formation, hydropower plant switchyard, Location of generator transformer, anchoring of HT conductor to dam and or power house building.

I. INTRODUCTION

A switchyard is the inter-connector between generation and transmission, at same voltage to evacuate generated power. In thermal power plants, switchyard generally exists adjacent to the power station.

Switch yard is HT switching area. Various equipments such as step-down transformers, circuit breakers, isolators, CT, PT, CVT, wave trap are almost the same in a switchyard, transmission or distribution substations. However, their ratings depend on the capacity of generating station, transmission substation, distribution substation. We may call broadly Generating station as bulk producer, Transmission substation bulk purchaser, Distribution substation retailer for consumers. As mentioned above switch yard formation at all places is similar.

The generation voltage is stepped-up to a transmission voltage e.g., 132 kV, 220 kV, 400 kV etc. using a generator transformer. The high voltage power is transmitted to the switchyard. If capacity of generating station is large, then capacity and voltage level of transmission substation may have to be raised, enhanced.

Station transformer to meet all the loads of a of the power plant (other than unit auxiliaries for which a separate transformer is provided). Generally, one station transformer is provided for a hydro power station and two in case of a thermal power station for initial starts. It is also needed during complete shutdown of power house for maintenance or during off peak hours (in case of hydro Power stations designed for peak hours operation). The hydel power projects are tailormade and there is no standard arrangement or locations of the switchyard. It varies from project to project [1-2]. A typical arrangement of the hydel power project showing reservoir, dam, penstock, power house, switchyard and tailrace can be seen in Figure 1.

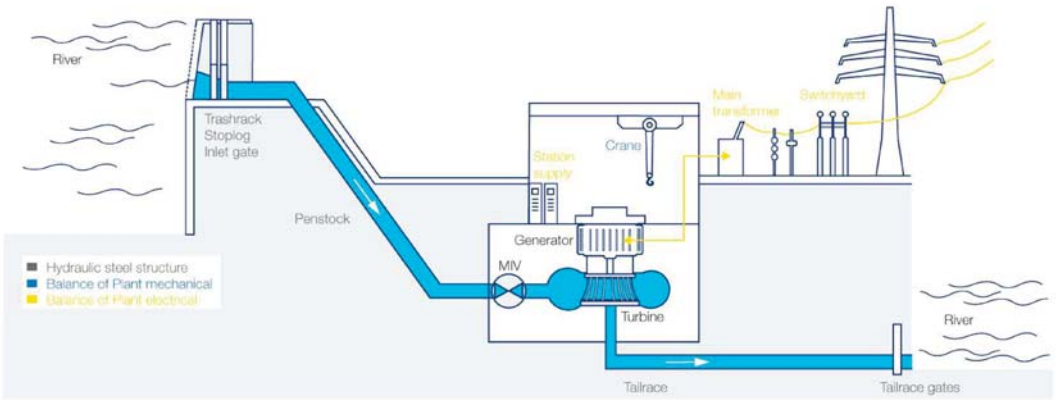


Fig. 1 Typical arrangement of a hydel power project [3]

II. Criterion in Designing Switchyard

Switchyard area requirement depends mainly on number of units, number of feeders and voltage level. It very rarely varies with the unit size. However, the area requirement varies considerably with the voltage level. To some extent it is proportional to voltage level.

The main difference in the switchyards of thermal and Hydel power stations is that the switchyard area in case of thermal power plant is quite adjacent to the power house building. The generator transformers are quite near to the switchyard. The unit size of thermal power station is so large (>200 MW) that generator transformers are to be installed very near to the power house building. It is because of the connection between generating unit and generator transformer is done by the isolated bus ducts. A marginal increase of distance of generator transformer from the generating unit will increase the cost of bus duct considerably. (As compared to this, a very marginal increase would be there in the cost of HT conductor).

In case of Hydel plants, the natural location of water fall or dam may be difficult to approach and very small area may be available near to the fall or near the dam location.

The power station has mainly two sections,

(a) Generating units and associated auxiliary services & equipment

(b) Power evacuation equipment system

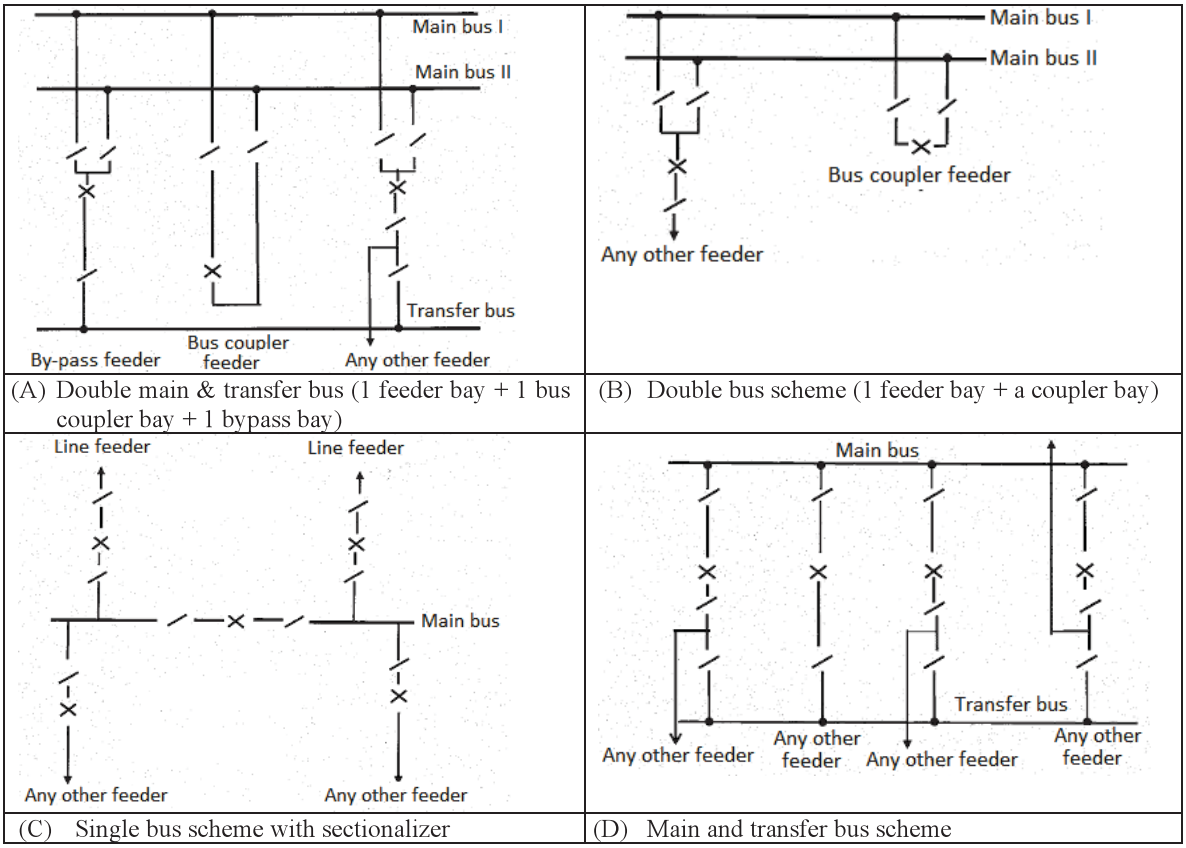
The broad considerations in planning of switchyard with specific reference to hydro power stations is discussed next.

III. Main Features of A Switchyard

There can be different bus-bar configurations.

i. Double main buses and a transfer bus: Opted in case of large capacity power stations, transmission substations having a greater number of units and feeders. Refer Figure 2 (A).
ii. Double main buses scheme: Generally opted for large capacity power stations, substations. Bus fault protection is provided to save tripping of healthy bus. Refer Figure 2 (B).
iii. Single main bus with sectionalizer: It generally opted for small capacity power stations, sub stations. Refer Figure 2 (C).
iv. Single main bus with transfer bus: It is normally opted for medium capacity power stations, substations where number of units and feeders together are more. Transfer bus is provided for maintenance of CB, CT of units or feeders. It is rarely opted in power stations. Refer Figure 2 (D).
v. The transfer bus is normally opted in thermal power stations as:

- It operates round the clock
- Number of units and feeders are, say 8,10 or more.



(A) Double main & transfer bus (1 feeder bay + 1 bus coupler bay + 1 bypass bay)

(B) Double bus scheme (1 feeder bay + a coupler bay)

(C) Single bus scheme with sectionalizer

(D) Main and transfer bus scheme

Fig. 2 Switch yard of hydro power projects [4]

Hydel stations generally operate during peak hours, hence get time for maintenance by taking shut down of all the buses or one of the two buses. The remaining units may remain in operation. Therefore, in Hydro Power stations single or double main system is used.

i. In single bus bar arrangement, sections are made for ease of maintenance by taking shutdown on one section. In hydro power stations, one unit and one feeder are included in one section. After opening of bus isolator of feeder or unit, if required the bus section can be taken in operation.

ii. Circuit breaker, isolators, C.T.: As far as possible these equipments are erected in their respective line parallel to main bus bar. Sometimes it may not be not feasible to cross the conductor over the bus bars. In such cases CB, CT etc. of generating units are arranged in one line on side of bus and feeders equipment in respective lines on other side of bus bar. In Pench Hydro power stations such arrangement has been provided.

iii. Bus bar P.T.: Generally, three single phase PTs on each bus are installed. In double bus arrangement, the CT for differential protection of bus is also provided. It is normally provided in thermal power plants and large capacity hydro Power stations. In that case, approximately half number of units and feeders are connected to one bus and remaining to other bus. This protects half number units and feeders from tripping on bus fault.

iv. Feeder CVT, wave trap, feeder isolator with earth switch: These are installed at the entry end of feeder.

The main features of any switchyard are generally their formations and types of arrangements as given below:

(a) Types of switchyards formations

(i) high level (ii) Low / normal level (iii) Step level

i. High level: It is opted in Hydro Power stations where plain land is not possible to create or costly. In this arrangement bus isolators are installed at high level gantry to save land space. However, these are operable from ground level. It has been used in Pench Hydro Power station.

ii. Low or normal level: It is conventional. The bus isolators of generating units and feeders are installed on ground level. It increases width of switchyard and so also area proportionately. The Bargi HPP and Hasdeo-Bango HPP switchyards are of this type.

(b) Types of bus bar arrangement

(i) Single main bus: In this bus arrangement only one bus is there where the generating units and feeders are connected. It is normally used in case of small hydro power stations having one or two generating units and feeders. The loss of power during bus shut down is minimal. Bargi Left Bank Canal small hydro power station has such arrangement. During long shutdown or reservoir level below low-level canal flow is maintained by operation of bye pass gates.

(ii) Single main bus with bus section: This arrangement is provided for comparatively higher capacity power stations. On each section one unit and one feeder are connected. For bus section isolation, breaker is seldom provided, it is achieved by bus isolator. In Rajghat Hydro power station this arrangement has been provided. In this Power Station, 3 units of 20 MW and 2 feeders of 132 kV are there. The project is interstate between U.P. and M.P. The share of U.P. in power is 1/3. Therefore, on one section one unit and feeder of UP are connected, second section one generating unit is connected. Third section third unit and M.P. feeder is connected. This has been done for ease in separate M.P. and U.P. grid operation, if required.

(iii) Double main bus arrangement: It is provided for large capacity power stations, where annual operation period is substantially high, number of units and feeders are more. The power stations are important from grid point of view. Half number units and feeders are connected to one bus and remaining on other bus to avoid tripping of whole power station in case of bus fault. This arrangement has been provided at Bargi HEP in M.P., Hasdeo Bango in Chhattisgarh at normal level and in Pench HEP in M.P. at High level,.All these are 132 kV switchyards.

The Pench Hydro Power station is an interstate project between MP and Maharashtra (M.H.), with the sharing of power 2/3 (M.P.):1/3(M.H.). In case of grid failure, one unit and feeder of one state are connected to one bus to provide starting to each state. Now due to strict norms of grid operation possibility of such situation is very remote.

(iv) Double main bus step type formation: In some hydro power stations, plain land is not available at single stretch or it may be very expensive and not eco-friendly to create plain area by large excavation. In such cases switchyard is constructed in steps, e.g., main bus-1 in first step and second step at higher elevation for bus-2. In case of Tons Hydro Power station due to steep hilly terrain this type of switch yard has been built. There is substantial level difference in levels of GT, bus-1, bus-2.

IV. Location of Generator Transformer

The location of GT also varies from project to project depending on the location of switch and/ or availability of space and LT side bus duct for GT.

(a) Draft tube Deck: Bargi Hydro (2 x 45 MW) In this project since switch yard is on tail race side generator

terminal also take to tail race side, bus straight way taken up to draft tube deck level, where GTs have been installed. The HT terminals taken to 132 kV tower erected near switch yard. The relative locations of GTs, PH, and switchyard are shown in rough sketch Figure 3.

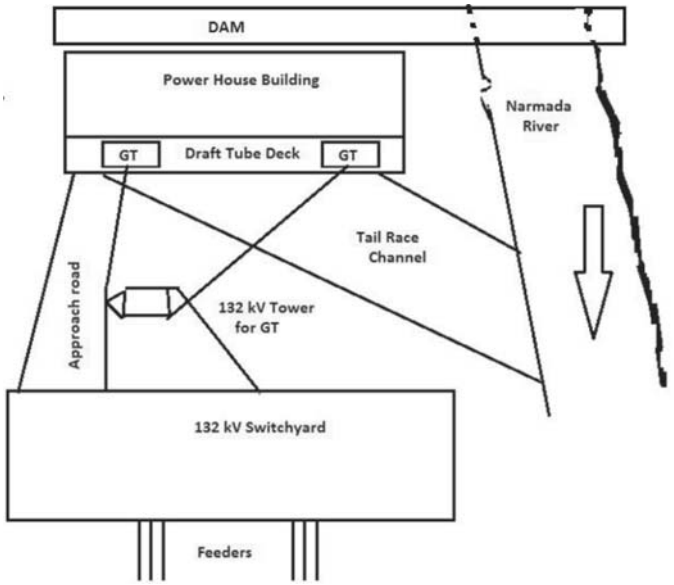


Fig. 3 Relative positions of power house building, G.T., and Switch yard of Bargi HPP

(b) GTs in Switchyard: Pench HEP (2x80 MW) The power house is underground about 100 meter deep below some portion of switchyard. The 100-meter length 11 kV bus ducts brought up to switch yard level through well provided for it and vertically down ward approach to power house. The power station main control room building is near to the well and switch yard. In case of any emergency concerned personal can go to machine hall through the well in about 10 minutes. The GTs have been installed near to well for ease of 11 kV bus duct connection. The relative locations of GTs, PH, and switchyard are roughly shown in Figure 4.

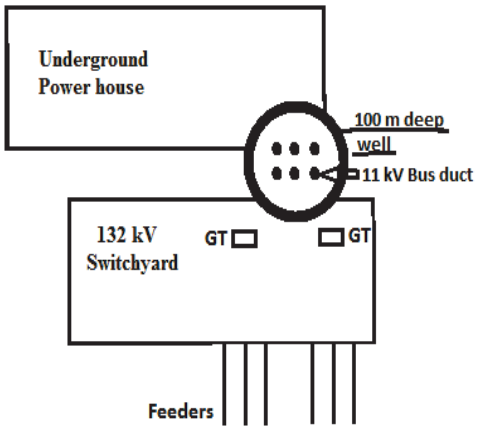


Fig. 4 Relative positions of power house building, G.T., and Switch yard of Pench HPP

In case of Rajghat (3×20 MW) Lalitpur (U.P.) and Marikheda (2×20 + 1×20 MW) Shivpuri (M.P.), GTs have been installed in switchyard and LT connection have been made by 11 kV cables due to low rating of generating units. It is observed that up to 20 MW unit size and 100 m length of HT cable connections are found to be economical

(c) GTs between power dam toe and power house building: In case of Hasdeo Bango HEP due to availability of adequate space between power dam and power house building GTs have been installed in this space.11kv bus ducts have been taken from up-stream side and straight vertically brought up to GT level. This arrangement has reduced length of bus duct considerably and also cost. The 132 kV HT conductors anchored between 132 kV towers near switch yard, to dam blocks, to power house building. The GT terminals have taken vertically upward to connect upper HT conductors for entry into switch yard. Rough setch in Figure 5 shows the relative locations of GTs, PH, and switchyard.

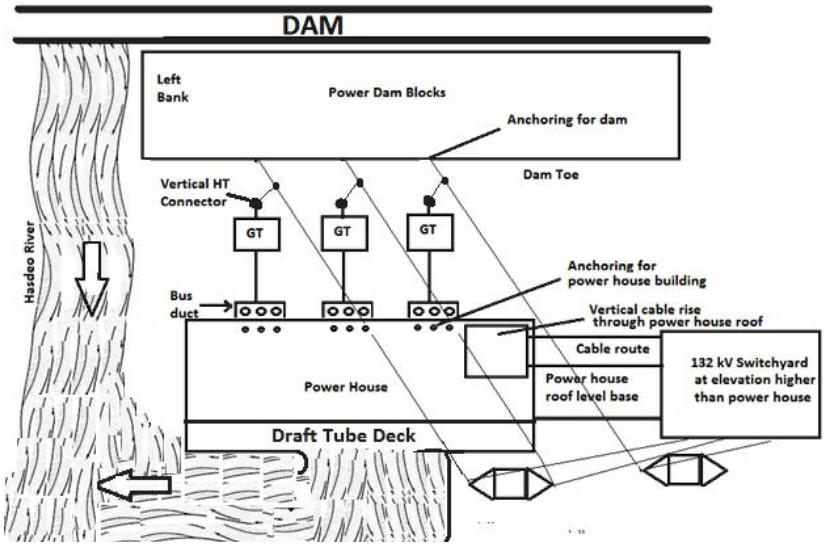


Fig. 5 Relative positions of power house building, G.T., and Switch yard of Hasdeo Bango HPP

(d) GT upstream side outside power house building: In case of Tons Hydro 3x105 the upstream side power house wall is abutting with tapper portion of step switch yard. Therefore, it felt convenient to place GTs near to upstream wall of power house building. The HT conductors have been very conveniently taken to switch yard on suitably located 220 kV towers. The rough sketch in Figure 6 shows relative locations of GTs, PH, and step switchyard.

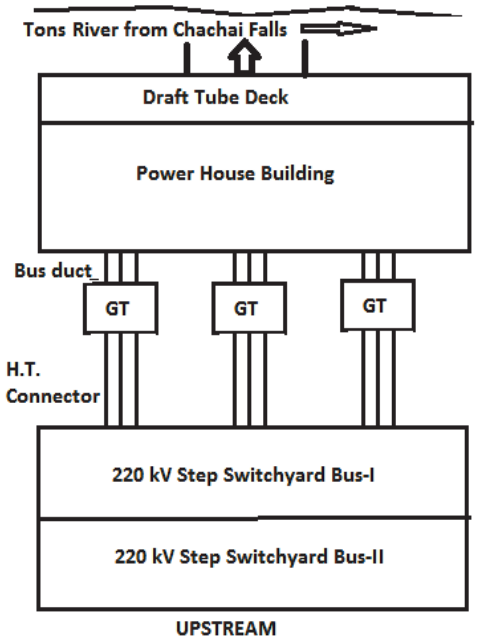


Fig. 6 Relative positions of power house building, G.T., and Switchyard of Tons HPP

(e) Earth Mat planning: As discussed in foregoing paras, the locations of power house building and switchyard may be quite far off and earth strata may also differ considerably. Therefore, earth Mat for power house building and switchyard may have to be designed independently. Sometimes, such apart locations may be advantageous. For example, the power house zero level earth may have almost zero earth resistivity due to seepage of water at that level, whereas switchyard may have to be located on hard rock strata with quit high earth resistance. Strong inter connection between two earth mats is made say by at least 4 riser of mild steel strips to get advantage of low earth resistance at power house zero level along with formation of equipotential area in power house and switch yard premises.

V. Conclusion

The overall planning of a hydropower project is very challenging as power house is taken near to the source of energy to the extent possible.

In case of thermal power plant, the energy source (coal) is transported to the convenient location of power station. Therefore, it is possible to locate thermal power station switchyard on most appropriate plain land near to the power house building where conventional layout of switch yard can be planned.

In case of hydel projects, two or three alternatives are to be examined. The location of generator Transformers also varies from project to protect. All these factors are challenging for designing, planning of switchyard of hydro power stations.

The location of switchyard affects the layout, routing of cable trenches. Sometimes, due to increased length of protection cables, their conductor cross-section needs to be reviewed to limit VA burden on CT or CT VA burden may have to increase to avoid its operation on knee point voltage. Thus, such vital points need consideration before finalizing the switch yard.

The author, as per his experience and memory has tried to highlight vital challenges and considerations faced during finalizing the planning of Switch yards of Hydro power stations. It is very likely that some deviations may be there from actual.

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Evolution of Wind Power Forecasting Techniques

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Abstract- *Wind Energy is variable in nature as it depends on sun, temperature, pressure variations and geography. Wind Energy based power generation poses problems in grid integration due to its fluctuating nature. Hence, it becomes necessary to forecast the wind power generation which is necessary for generation scheduling. The wind power forecasting helps the wind farm operator to convey reliable generation data to the load dispatch centre to facilitate generation scheduling needed for stable operation of Grid. This paper summarises some of the developments in the field of Wind power forecasting which may help researchers in formulation of a wind power forecasting model. Increasing wind energy penetration avoids carbon emission whereas wind power forecasting facilitates optimum utilization of wind resource.*

Keywords: Wind Power Forecasting, Artificial Neural Network, Generation Scheduling

I. INTRODUCTION

Electrical Energy plays an important role in the development of any nation, as it helps in increasing the industrial, transportation and agricultural activities. To fulfil these energy needs and to reduce the carbon emissions, the renewable energy dominated by solar and wind energy, are playing important role but both these resources of renewable energy are variable in nature. India is an emerging economic powerhouse. It is also the world's third largest energy consumer and emitter of the greenhouse gas which are responsible for global warming resulting in climate change. India has voluntarily committed to achieve about 40% energy needs from non-fossil fuels by 2030 [1-3]. According to Ministry of New and Renewable Energy, already non-fossil fuel energy electricity capacity was 38% of India's total installed electricity, from that almost 25% is from renewable energy sources as of May 2021. As of Feb 2021 the total installed wind power capacity of India was 38.789 GW, i.e., about 10% of India's total installed power capacity. India has the fourth largest installed wind power capacity in the world. Wind Power Forecasting becomes necessary for generation scheduling and also for optimum utilization of wind resource.

i. Wind Power Forecasting

Wind power forecasting is a technique which estimates the power production of a wind turbine in the future. Usually these are carried out in two steps:

Step 1: To predict the wind speed and direction for a given location.

Step 2: To convert the predicted wind parameters to wind power and on this basis electrical output of generator.

Due to the variability of the wind, there can be seasonal changes, daily cycles and fluctuations at a few minutes scale. The variability is mainly due to temperature changes, altitude change and pressure changes. An efficient forecasting algorithm plays key role in minimising the error in wind power forecasting which in-turn helps in maximizing the use of wind resource.

While modelling a wind power forecasting modelling, some factors are to be kept in mind:

(a) Winds are uncertain in nature hence,

i. They pose a revenue risk as compared to conventional power plants which means higher cost.
ii. Due to global climatic changes, as wind power plants operate for decades. Forecasts should have high accuracy in predicted values.

(b) The decisions for the operation of the wind power generation in accordance with the grid has to be based on,

i. The forecast of wind resources over the course of next several minutes or hours should have minimum error.
ii. Forecasts should be accurate enough to aid in the smooth integration of wind power with the grid.

(c) Improvement in the technology of turbine, converters, and structure extends the lifetime of wind power generation projects.

In the Indian scenario, NIWE (National Institute of Wind Energy) directly or through empanelled organisations has been providing high quality forecasting and scheduling of wind power in India forecasting [4].

(d) Classification of wind power forecasting based on time scale:

Forecasting algorithms are normally classified on the basis of time. Forecasting time limits are not strictly defined and it varies depending on the application for which the forecasting model is designed. They can be classified as follows based on the time period:

i. Short Term Forecasting (Few Minutes to Few Hours Ahead) [16]

This is needed for Load based planning (like decisions for increment or decrement of loads). It is also useful for turbine active control and for buying and selling of electricity-based decisions in combination with the grid.

ii. Medium Term Forecasting (Few Hours to 1 Day Ahead) [9][11][20][31][37][28][25]

This is needed for Base Load Generators based decisions (like whether it has to be online or offline), for energy trading and for operational security of the grid one day ahead.

iii. Long Term Forecasting (1 Day Ahead to 1 Week or more) [29]

This is needed for reserve-based decisions (like procurement or processing of coal), and for carrying out maintenance activities (like scheduling maintenance for wind farms, transmission lines or other power plants connected with the grid), and to obtain the optimum operational costs for a grid.

II. Design of a Wind Forecast Model

There are certain steps which are to be followed for the design of a Wind Forecasting model, there cannot be a generalised approach as the model designed will be for a specific location or specific site. The steps listed below showcase a generalised format in which any wind forecasting model can be designed and optimised from scratch.

(a) Data Selection

Depending on the interval for which forecasting is to be made and the model selection, the data required would change. The selection and processing of data to be fed, plays the most important role for designing any forecasting model. This has to be achieved by the researcher after careful considerations and depending on the availability of data.

(b) Selection of input parameters

Before starting with any wind power forecasting model so on this the optimised model will function and forecast the selected parameter.

Some of the commonly used inputs for wind power forecasting are temperature [12][19][31][33][5], peak wind speed[5], wind power[me inputs are to be fed to the model which is going to be designed and based [4][7] [9][10][11][13][14][15] [19][20] [31][33][25], metrological parameters[11][13], wind speed [9][12][13][14][19][31] [33][28][25][27], average wind speed[22], wind direction [13][19][31][33][5], fan blade angle [9], relative humidity [12][31][33][5], numerical weather prediction data(NWP) [10][14][25], Global horizontal irradiance GHI [5], air pressure[12][19][5][27], vapour pressure[12].

(c) Selection of output

The main aim of designing any model for wind power forecasting is to find out the output power that will be produced by the wind power plant in consideration. Depending on the type of model used the outputs for wind power forecasting can be predicted wind speed [7], wind power [9][27].

(d) Implementation and Validation of forecast model

There are a variety of models that can be used for wind power forecasting to determine its energy output. The selection of a model depends on various factors like the selection of input variables, the application. They are classified as follows

i. Persistence Method/ Naive Predictor

It assumes that the wind power to be forecasted at a certain interval will be the same and it will depend on the last measured value. Some of the researchers have used Naive predictors or Persistence Method [6][8] [9][15][25][34][35] as these prove to be accurate for short term predictions

ii. Physical Approach / Numeric Weather Predictors

This depends on the Numerical Weather prediction models and uses them as the inputs. These models are based on the equations of motions and forces affecting fluids. Based on the data from atmospheric variables the system of equations will allow the estimation of wind power. Some of the models are Global Forecasting System [4][19], Prediktor [19], Numerical Weather Predictor (NWP) [34][37], Physical Approach [34][35].

iii. Statistical Approaches [34][35][37]

These are based on one or more methods. They basically establish a relation between the past values of power generated as well as the past and forecasted meteorological parameters. These are further classified as

iv. Artificial Intelligence Models

These are models which use artificial intelligence which mimic the operation of a human brain to learn from the data given. This tries to generalise a pattern and apply the learning to estimate the future values based on past performance. Some of the models are Feed-forward Neural Networks [5] [12], Recurrent Neural Networks[36], Multilayer Perceptron Network[36], Radial Basis Function based Neural Network[8][31], Back Propagation Neural Networks [5][17][22][28], Support Vector Machines [5][9][33][35], Fuzzy Logic [35], Wavelet Transform [11], Ensemble Predictions [14][18], Genetic Algorithm[35], Particle Swarm Optimization (PSO)[23]

v. Time-series Models [34]

These models have the involvement of a time component. A time series is a sequence of observations taken sequentially in time. Forecasting is done by modelling based on past data and using them to predict the actual outcome which may not be known till the future date. Some of the models are Auto Regressive Moving Average with Exogenous Input (ARX)[34][15], Auto-Regressive Moving Average(ARMA)[6][8]34][35], Auto Regressive Integrated Moving Average (ARIMA) [26][31][34], Grey Predictors[34], Linear Predictions[34], Exponential Smoothing[25][34], Probabilistic forecasting [7][8][10][14][18][20][21][24][25][26], Gaussian process [8][21][24][35]

vi. Hybrid Models

These models try to combine one or more of the previously described methods, in doing so they combine the benefits of each model and hence obtain a better forecasting performance. Some of the models are ANN + Fuzzy logic =

ANFIS [27][34][35], Elman Neural Network (ENN) algorithm trained by PSO [11], Cooperative Co-evolution Genetic Algorithm (CC-GABP) based on Back Propagation (GABP) Neural Network [12], Least-Squares Boosted Regression Tree Method (LSBRT) + Cost-Oriented Boosted Regression Tree Method (COBRT) [13], Lasso-Type Estimation of Autoregressive Models [15], Non Linear Regression Model +Machine Learning [4], Bootstrap Based Extreme Learning Machine (BELM)[20], Input Parameters Selection-Particle Swarm Optimization Algorithm-BP Neural Network (IS-PSO-BP)[22], Enhanced Particle Swarm Optimization Technique (EPSO) and Modified Hybrid Neural Network (MHNN) [31], Hybrid Intelligent Algorithm (HIA) approach+ Extreme Learning Machine(ELM) and Particle Swarm Optimization[25], Back-Propagation NN and Chaotic Shark Smell Optimization Algorithm (CSSO) [17].

(e) Activation Functions

Artificial Intelligence and Machine learning based models are being developed and widely used nowadays for Wind power forecasting, these models use Activation Functions to determine the output of a neural network. An artificial neuron estimates the weight of its input and adds a bias to it and gives an output, based on this output the neuron decides whether it should be activated or not.

$$Y = \sum (Weight * Input) + Bias \cdots\cdots (1)$$

The activation function is usually used to limit the amplitude of output of a neuron. It maps the resulting values in between 0 to 1 or -1 to 1 etc. (depending upon the function). The Commonly used activation functions are:

i. Step Function [37]

This is basically a threshold-based activation function, when the value of the output from a neuron is above a certain value it is declared as activated. If it's less than the threshold, then it is not activated.

$$f(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases} \cdots\cdots (2)$$

ii. Linear Function [37]

This is a straight line function where the activation is proportional to the inputs to the neuron which is the weighted sum from neuron.

$$f(x) = x \cdots\cdots (3)$$

iii. Sigmoid Function [37]

This is a non-linear function and has a fixed output range. Sigmoid takes a real value as input and outputs another value between 0 and 1.

$$A = \frac{1}{1 + e^{-x}} \cdots\cdots (4)$$

iv. Tanh Function

This is also a non-linear function, but more preferred than Sigmoid. Tabs fits a real-value number to the range [-1, 1], its output is zero-centered.

$$tanh = \frac{e^{x} - e^{-x}}{e^{x} + e^{-x}} \cdots\cdots (5)$$

v. ELU (Exponential Linear Unit) Function

This function tends to converge to zero faster and produce more accurate results. Different to other activation functions, it has extra alpha constant which should be positive number.

$$R(x) = \begin{cases} x \text{ for } x > 0 \\ \alpha(e^{x} - 1) & \text{for } x \leq 0 \end{cases} \cdots\cdots (6)$$

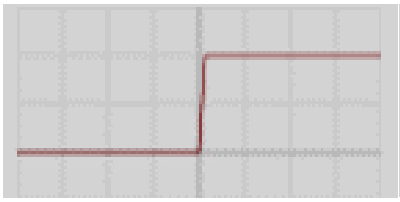

Fig. 1a Step Function

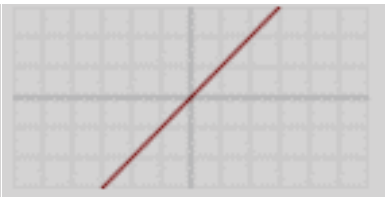

Fig. 1b Linear Function

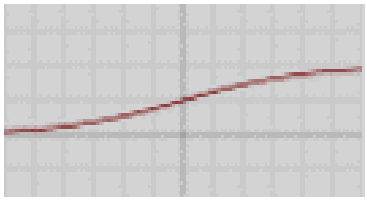

Fig. 1c Sigmoid Function

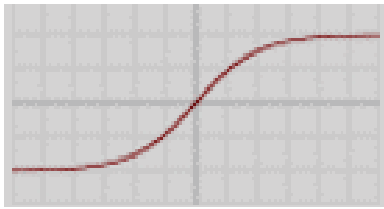

Fig. 1d Tanh Function

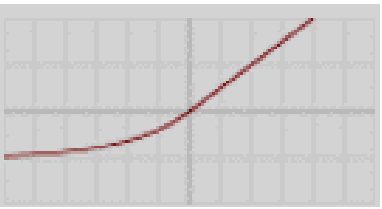

Fig. 1e ELU Function

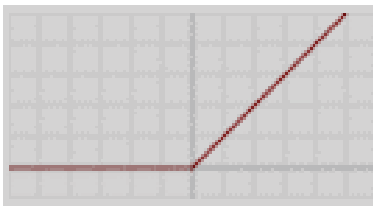

Fig. 1f ReLU Function

vi. ReLU (Rectified Linear Units) Function

This is also a non-linear function and most widely used nowadays and provides the same benefits as Sigmoid but with better performance.

$$R(x) = \begin{cases} x & for\ x > 0 \\ 0 & for\ x \leq 0 \end{cases} \cdots\cdots (7)$$

(f) Comparative Evaluation

The models designed are to be compared with already existing models so that it can be ensured that the designed model is more accurate, efficient and optimised. There can be a comparison between any two or more models which are applicable in a certain area of wind forecasting. Another important tool for comparison can be the errors, there are a

variety of errors that can be compared, let us look into various errors considered by researchers for wind forecasting.

(g) Errors in Wind Forecasting

The error measurement between the forecasted value and actual value is useful in order to evaluate the performance of the model. And it is also necessary to understand these forecasting errors in order to provide the necessary feedbacks required to improve the forecast accuracy.

i. Mean Absolute error (MAE) [8][11][12][16][19] [20][21][22][23][34][35]

The Mean Absolute Error is a simple measure of error value. This is simply the mean or average of the value of absolute error.

$$MAE = \frac{1}{n}\sum|forecast_t - actual_t| \cdots\cdots (8)$$

ii. Mean Absolute Percentage Error (MAPE) [22] [34][17]

The Mean Absolute Percentage Error is the absolute error normalized over the actual value, this is computed for every data values and then averaged.

$$MAPE = \frac{1}{n}\sum\left|\frac{forecast_t - actual_t}{actual_t}\right| \cdots\cdots (9)$$

iii. Normalized Mean Absolute Error (NMAE) [9][31] [8][17]

The Normalized Mean Absolute Error is the average of mean absolute error normalized over the average of all the actual values

$$NMAE = \frac{\sum|forecast_t - actual_t|}{\sum|actual_t|} \cdots\cdots (10)$$

iv. Mean Square Error (MSE) [12][21][22][34][35][28]

The Mean Squared Error is a measure of the closeness of a fitted line to the given data values.

$$MSE = \frac{1}{N}\left(\sum(forecast_t - actual_t)\right)^2$$

v. Root Mean Square Error (RMSE) [8][12][15][20] [21][23][31][34][5][35][18]

The Root Mean Square Error is the square root of the mean square error

$$RMSE = \sqrt{\frac{1}{N}\left(\sum(forecast_t - actual_t)\right)^2} \cdots\cdots (11)$$

vi. Normalized Root Mean Squared Error (NRMSE) [9][8][17]

The Normalized Root Mean Square Error is the average of the root mean square error normalized over the average of all actual values. It is useful to compare models with different scale.

$$NRMSE = \frac{RMSE}{\sum actual} \cdots\cdots (12)$$

vii. Mean Absolute Scaled Error (MASE) [8]

The Mean Absolute Scaled Error (MASE) is a scale-free error metric that gives each error as a ratio compared to a baseline's average error.

$$MASE = \frac{1}{N}\left[\sum_{t=1}^{N}\frac{actual_t - forecast_t}{\frac{1}{N-1}\sum_{t=2}^{N}|actual_t - actual_{t-1}|}\right] \cdots\cdots (13)$$

viii. Average Relative Error (ARE) [23]

The Average Relative Error is a traditional performance index which is used for the measure of prediction accuracy.

$$ARE = \frac{1}{N}\sum_{t=1}^{n}\frac{|forecast_t - actual_t|}{actual_t} \cdots\cdots (14)$$

ix. Absolute Relative Error (RAE) [27]

The Absolute Relative Error is a metric comparing actual forecast error to the forecast error of a simplistic model.

$$RAE = \frac{[\sum_{t=1}^{n}\{forecast_t - actual_t\}^2]^{\frac{1}{2}}}{[\sum_{t=1}^{n} actual_t^2]^{\frac{1}{2}}} \cdots\cdots (15)$$

x. Coefficient of Determination (COD) criteria [34]

The Coefficient of Determination is used to analyze how differences in one variable can be explained by a difference in a second variable. It is a measure of the degree of relationship between two individuals.

$$(R)^2 = 1 - \frac{\sum_{t=1}^{n}(\text{actual(t)} - \text{forecast(t)})}{\sum_{t=1}^{m}(\text{actual(t)} - \text{meanof actual values})} \cdots\cdots (16)$$

III. Conclusion

Wind power forecasting techniques have seen a drastic change in the past decades. It has shown improvement from a mere prediction-based model to Artificial Intelligence based models nowadays. Based on the survey some points can be highlighted as follows:

i. The wind power forecasting techniques should be combined with the grid management system for low cost and reliable operation of the grid.
ii. Work has to be carried out for reduction of the uncertainty prevailing in wind energy forecasting, which will make it more reliable and more risk free from the view point of investors.
iii. Models should be developed which can work in the short-term forecasting and can be used as effective tools for increasing the reliability of a wind power plant.

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Operation and Maintenance Problems of Hydro Power Units – Research Based Solutions from Real Life Typical Cases

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Abstract-*This paper attempts to present a combined view of various operation & maintenance problems in the areas of turbine, generator, governing and associated equipments, static excitation system and various other auxiliaries, which are constituents of a Hydro power generating unit in a Hydro power station. The effect of these problems on the relevant part of the machine is brought out together with remedial measures to solve them and to prevent their recurrence as a long term measure.*

Keywords: Draft tube; Generator circuit breaker, Main slide valve of governor, Cooling Water, Push Button; Governor Oil; Tripping logic; Cavitation; load throw off: Flooding of power house; Stator earth fault; Generator Field Breaker, Electro hydraulic transducer.

Abbreviations: AVR: Automatic Voltage Regulator; CW: Cooling Water; DT: Draft Tube:EHT: Electro Hydraulic Transducer; ESV: Emergency Slide Valve; GA: Guide Apparatus; GCB: Generator Circuit Breaker; GFB: Generator Field Breaker; MSV: Main Slide Valve; OPU: Oil Pressure Unit; PB: Push Button; PH: Power House; DW: Dewatering; TRC: Tail Race Channel.

I. INTRODUCTION

To harness the renewable energy of available water resource, it is well known that Hydro Power Stations are uniquely designed/built based upon many factors like topography of surroundings, upstream storage capability, downstream requirements etc. This uniqueness leads to requirement to manufacture and supply a tailor made machine consisting of turbine for specific conditions of head; discharge, submergence etc. and matching generator and associated equipments. The Governing system which controls the machine is also part of this uniqueness, whereas the excitation system which puts life in the machine is quite independent of its type [1].

Operational problems may start appearing from day one on first spinning of a new machine or after capital maintenance thereof, until its first synchronization and loading in the grid. Usually, such problems are tackled jointly by site engineers of manufacturers and the owner and thereafter, 72 hours continuous on load run would further confirm suitability of the machine for commercial operation by the owner under guidance of manufacturer's engineers.

A new machine in the hands of owner for operation can give more problems until their operation and maintenance engineers get comfortable with various operational procedures, routine maintenance requirements etc. as per the operation and maintenance manuals of suppliers and site commissioning reports of the machine.

II. PROBLEMS IN THE MECHANICAL/ELECTRICAL AREAS

In the Table 1 below, the problems of mechanical nature related to turbine, generator, water conductor system etc. and of electrical areas for governor and excitation system etc. are given, which have been usually encountered in the past at various project sites.

Table 1: Problems, Cause & Effects and Remedial Measures [2-3].

S. No	Problem	Probable Cause(s)	Effect on performance and remedial measures	Remarks
1.	Very fast rise or excessive slow rise of guide bearing temperatures during first run	1. Presence of foreign material in the bearing housing 2. Unbalance of rotor 3. Low oil level in bearing housing 4. Wrong bearing clearances 5. Inadequate bedding or chamfering of pads 6. Poor cooling of pads from insufficient oil/CW circulation 7. Un calibrated/defective thermo sensing devices	1. Commissioning schedule distributed 2. Replacement/repair of pads and journal cleaning 3. Oil replacement or its cleaning and testing 4. Re-calibration of thermo device(s) 5. Re cleaning of bearing housing 6. Resetting of clearances	1.Very fast rise in temperature is the result of rubbing which causes damage to babbit metal of pad(s). 2.Tripping on over temperature protection will not work on rubbing.

2.	Rubbing of rotor fan with air guide(s) or vapor seal segment(s) touching shaft or Kaplan runner hitting its chamber	1. Inadequate clearances during erection	1. Stop machine and increase clearance(s) 2. Scrapping of runner chamber to increase clearances will be time consuming	Vapour seal segments can be installed later after balancing
3.	Excessive vibrations/noise	1. Rotor unbalance 2. Pressure Pulsations in turbine 3. Unequal GV^S Opening 4. Excessive bearing clearances or non-concentric bearing circles	1. Fatigue failures 2. Commissioning delay 3. Inability to take full load	Carry out balancing of rotor as soon as possible
4.	Oil splash from guide bearing(s)	1. Inadequate height/varying gap between oil retaining sleeve and shaft 2. Excessive incoming oil but inadequate outlet 3. Less viscous oil	1. Loss of bearing oil and chain of defects	
5.	Excessive thrust bearing temperature	1. Unclean bearing housing 2. Excessive/Uneven load on pads due to i) Hydraulic thrust more than designed ii) Incorrect difference in magneticaxes of stator and rotor iii) Uneven spring mattress bed/setting of pads 3. Inadequate cooling	1. Likely damage to bearing causing forced shut down for repair/resetting or replacement of pads/springs	
6.	Excessive sound from flow of CW in pipes	1. Oversized pipes vis-à-vis required rate of flow	1. Health problems of operators 2. Difficulty in talking/hearing in the PH	Use globe valves instead of gate valves to control flow
7.	Mixing of water and oil in the bearings	Oil cooler tube failure	Poor performance of bearing in the long run	Installation of moisture detector in bearings suggested
8.	Excessive carbon brake dust/oil vapor deposition on stator/rotor windings and brake track surface	1. Bearing vapor seal non – performance 2. Brake dust collector not in service 3. Carbon brush bedding on slipring not done properly or incorrect brush material,spring pressure	1. Winding Insulation Deterioration 2. Increase in brake duration 3. Sparking at slip rings	1. Periodic Cleaning is required at slipring area/rotor inter polar joints, stator overhang winding
9.	Faster wear of brake shoes/grooving in brake track	1. Higher speed/pressures of brake application than necessary 2. Incorrect material of brake shoes/pads	Frequent replacement of brake shoes and forced shut down	Generator manufacture guidelines to be followed
10.	Shifting of rotor lead or cover plates Between the arms of rotor hub	1. Improper tightening/locking of fasteners 2. Non-butting of plates against stopper		Inspection of rotor after over speed is mandatory
11.	Periodic enlargement of	1. Rotor swings during operation in grid	Increase in vibrations	

	guide bearing clearances	2. Improper locking/doweling of bearing house		
12.	Flooding of power house/submergence of Generator/ Control panels etc.	1. Breakdown of cast iron valve during operation used for CW tapping from penstock 2. Break down of PH wall during water release from opening of adjacent bypass gate 3. Unforeseen reasons like heavy rains entering PH or retaining wall collapse on downstream side during erection stage	1. Complete disruption of ongoing works 2. Great efforts required for dewatering of PH 3. Re-conditioning or replacement of submerged parts 4. Generator and control panels dry out and recommissioning	1. Use cast steel valve instead of cast iron valve 2. When required open farthest bypass gate from the PH wall 3. Contact manufacturer for guidelines for restoration
13.	Excessive foaming sludge formation of governor oil	1. Mixing of 2 groups of oil	1. Malfunctioning of governing system	Use same oil type for top up
14.	Repeated failure of shear pins of guide vanes	1. Excessive lifting of regulating ring due to faulty erection of GA system 2. Foreign matter lodged between GV^Sduring stopping 3. Excessive deflection/tilting of top cover	1. Forced downtime for restoration of normalcy	Intake gate falling may be required if speed doesn't fall sufficiently to apply brake
15.	Excessive water leakage through GV bush housings	1. Inadequate sealing 2. Inadequate greasing inside the bushes	1. Flooding in turbine pit requiring additional DW pumps 2. Danger of Water/Moisture ingress in turbine bearing 3. Unpleasant view of turbine pit space	Care is required for proper fitting of cup seals and 'O'rings during erection
16.	Excessive closing time of servo motors in the damping zone during load throw or upon stop command for normal stopping	Mismatch of holes of throttle device and servomotor piston rod, due to some turning of the latter	1. Load throw process gets disturbed 2. Emergency closing signal may get generated on 'GV^S fail to close in preset time', Causing more complications like intake gate falling etc.	1. Problem must be attended as soon as possible 2. Proper locking of piston rod must be ensured in correct position.
17.	Internal oil leakage in the governing system	1. Conicity in servomotor cylinder 2. Excessive clearance due to wear between piston and cylinder of servomotor(s)	1. Frequent loading/unloading or start/stop of OPU pump motor 2. Heating of oil/pipes/motor	
18.	External oil leakage from the governing system	1. Kaplan runner trunnion seal damaged 2. Servomotor shaft chevron packing failure	1. Oil loss in TRC or turbine pit 2. Water entry in governor oil system leading to its mal-functioning	1. Periodically check for floating oil in TRC 2. Chance of runway speed due to governor failure
19.	Continued loss of metal from runner/stay vanes	1. Excessive cavitationdamage from part load operation or other reasons	1. Forced shut down for repairs 2. Possibility of higher vibrations, lower efficiency	1. Repair by weld deposit of same material or by

	etc. during operation	2. Erosion/corrosion damage from silt		application of polymer coatings
20.	Non performance of bearings	1. Bracket shifting or sinking of foundations 2. Excessive temperatures 3. Deterioration of oil quality	1. Major problems likely in long term requiring prolonged shutdown	1. Periodic Centrifugal/electrostatic cleaning of oil and testing is suggested
21.	Turbine shaft working seal failures leading to water escape (main seal)	1. Clean Cooling water unavailable to seal 2. Excessive runner top cover pressure 3. Material selection incorrect with respect to surface velocity requirement 4. Inadequate spring pressure	1. Loss of energy generating water 2. Chance of flooding of turbine guide bearing and pit increased	1. Signaling of CW failure to seal should be acted upon immediately
22.	Turbine shaft isolation seal failure (Air inflated repair seal)	1. Joint failure in rubber ring 2. Insufficient air pressure for expansion of rubber ring to make proper contact all around with the shaft	1. Even for smallest work in main seal, dewatering of DT will become necessary	1. Periodic gap checking after/before inflation should be done
23.	Dewatering/Drainage problems of turbine DT and PH	1. Choking of rather long pipes of systems by mud etc. causing tripping of pump motors 2. Excessive leakage from dropped down DT gate 3. Excessive leakage from the closed penstock gate (which is let into DT during dewatering).	1. Delay in dewatering causes increased shut down duration or delays in erection schedule of new units	1. Repeated switch ON of dewatering pump motor should clear the pipes of mud 2. Services of divers may be required to plug leakage from DT gate
24.	In single PB start, machine over speeds	1. GCB interlocking contact in start circuit closed inadvertently	1. Requires restart after trouble shooting	Over speed protections must be effective
25.	Machine not starting in auto governing	1. Starting Interlocks not through 2. ESV not reset or mal-functioning 3. Governor malfunctioning (Mechanical/Electrical)	1. Requires restart after trouble shooting	
26.	Machine not starting even in manual governing mode	1. Governor MSV jammed due to ingress of mud 2. Inadequate water pressure in spiral 3. Generator brake ON 4. HS lube pump off 5. Mechanical problem in governor limiter mechanism	1. Restart after trouble shooting 2. Clean governor oil and flush the sump and pipes to remove mud and sludge etc.	1. Periodic cleaning of governor oil sump is suggested 2. Brake ON/ OFF status should be physically checked before starting
27.	Machine stopping after load throw	1. Micro switch for detection of MSV movement in closing	1. Repeat load throw after trouble shooting	1. Machine must run in no load excited after

	instead of continuing to run on no load	direction malfunctioning in HMC of governor.		successful load throw
28.	GCB tripping immediately after synchronizing	1. Protection PT secondary voltage absent which initiates backup impedance protection	1. In trouble shooting, malfunctioning of PT secondary sliding contacts may be found. 2. Operation of some electrical fault protection.	A look at control room annunciations would provide the clue
29.	Machine stopping or over-speeding unnecessarily on some faults	1. Wrong tripping logic adopted for faults in design	1. Review logic 2. Un necessary effort for restarting 3. Loss of water energy due to no load run involved for restarting	A commonly agreed tripping logic at design stage is necessary
30.	Over voltage tripping during field flashing in auto (manual ok)	1. Excessive control voltage build-up during the process in AVR card	1. Adjust control voltage limiting circuit in AVR card	In new machine field flashing in manual mode must be proved at first
31.	Stator E/F in a machine during operation	1. Unclean external connected equipment like generator terminals/bus duct insulators/XLPE cable connection to main transformer etc.	2. Loss of generation during the period of down time 3. Cleaning alone may solve the problem which should be first undertaken before any other measure.	After successful final acceptance HV test before commissioning, no likelihood of winding failure for 25 years is expected.
32.	Inadvertent application of brake in a running machine	1. No clear marking of unit number in a multi unit PH 2. Malfunctioning of auto braking system	1. Extensive damage to brake track and pads 2. Lowering of IR (insulation resistance) of generator windings from brake dust laden fumes of oil.	1. Unit number must be reliably marked on panels, turbine pit, generator barrel etc. 2. Manual braking may be preferred
33.	Inadvertent closing of governor main oil valve during operation in grid	1. Malfunctioning of control circuits of motorized valve 2. Wrong operation by operator say in case of LT supply failure in the power house.	1. Likelihood of machine going to runaway speed if GCB trips during this time	1. Manually operated valve is preferable
34.	Generator over voltage tripping during field flashing both in auto and manual modes	1. Dirt/Dust accumulation in thyristors over a long period	1. Cleaning of Thyristors and checking for their healthiness	1. Periodic cleaning of excitation panels is necessary
35.	Abnormal noise and sparking at the time of GFB tripping on load	1. Pulses from pulse generating card not moving in inverter mode	1. Check the circuit and the card	1. Harmful to long life of GFB from such sparking
36.	Jerky/erratic behavior of GA together with jerks in governor oil	1. Contamination of governor oil 2. Flapper of EHT of governor not in center or its looseness	1. Forced shutdown to attend the problem 2. Reduction in life expectancy of equipments	Periodic oil cleaning and testing in

	pressure gauge during operation			Certified Lab is necessary
37.	Sudden noisy operation of OPU pumps of governor	1. Choking of filters in the sump tank of governor	Thoroughly clean the filters one by one, periodically	Periodic maintenance is essential

III. Conclusion

The construction of hydro power stations and units being a highly tailor made effort at every stage from concept to commissioning, it is but quite natural to face some unforeseen problems during operation and maintenance, some of which have been brought out in this article, on a holistic basis to cover not only the mechanical side of turbine, generator, governing systematic, but also of their electrical side, including the excitation and protections part. This will make aware all concerned about various problems faced at severalhydro stations in the past over many years and their repercussions on performance/life expectancy etc. along with brief analysis and suggestions for avoidances. Needless to say, everybody's objective is to achieve minimum or no forced outage for maximum availability of equipment for generation of electricity for greater good of the nation. For this, it would be highly desirable on the part of owner of PH not to move those operation and maintenance engineers who were associated with erection/commissioning –activities, at least up to first capital maintenance.

For effective maintenance, well defined maintenance schedules of daily, weekly, monthly yearly intervals and capital maintenance should be prepared based on Operation and Maintenance manuals of suppliers as well as experience of other similar units elsewhere, which should be religiously followed. This can be done in such a way that not more than 5 to 8% of total generation time is spent for it as a guideline. Of all the problems, excessive vibrations are the most harmful for the machine as these cause fatigue stress on various components, resulting in reduced life expectancy, low performance level and dissipation of energy. It is therefore necessary to periodically monitor vibration condition of the units and to reduce these as for as possible.

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An Overview of Hydroelectric Power Development

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Abstract- *In this paper, the challenges imposed by climate change and the role of hydropower in mitigating the impacts of climate change are discussed. The outline of development made in hydropower in India and the world are also explained. There are hydropower projects that have completed more than 100 years and are still in operation. The main objective of hydro schemes has generally been a water management and to preserve and supply water for drinking, irrigation, industries, and hydroelectric power development. The working of hydropower plant along with the approach to control the voltage and frequency are included.*

Keywords**:** History of hydropower development, working of hydropower plant, global and Indian scenario of hydro power development.

I. Climate Change And Hydro Power

Climate change is one of the biggest global challenges of the 21st Century. The rapidly increasing severe disasters are the evidence of impacts of climate change. Lives on earth are already affected because of rising temperatures, sea levels, changing wildlife, floods, droughts, storms etc. Any further delay in taking the corrective measures threatens to cause enormous damage to the mother earth, the only known planet that supports lives.

Water is a major source of renewable energy and is the indispensable natural resource for the existence of living beings on earth. Hence, there is no other way to conserve water. In order to fulfil the ever-increasing demand for water, meticulous management of water has become all the more significant. Hydroelectric power is a renewable and an eco-friendly source of power generation and plays important role in the fight against climate change.

It is further to mention that in recent years, the ambient temperature has been increasing alarmingly. The weather experts are of the opinion that it is causing high absorption of moisture, which is causing sudden high floods, storms etc. This underlines the necessity of exploring the possibility of planning new dams to minimize/avoid such floods.

II. History Of Hydropower Development

Solar heat causes the water cycle. The water at a height possesses the potential energy and water flows downwards due to the earth's gravitational force. Thus, potential energy gets converted into the kinetic energy. There is a long history of over 2000 years of the usage of hydropower for mechanical applications, mainly grinding the grains and pumping of water for irrigation. In the late 19th century, the generation of hydroelectric power started. Since then, a lot of research and innovations have taken place in the development of modern turbines.

Hydropower is an eco-friendly source of clean energy and does not require any burning of fuels and hence there is no emission of gases. Operation and maintenance costs of hydropower generation are much lower than other types of power plants. The cost of generation also reduces with time. In fact, dam-based storage type projects are multi-purpose and offer several benefits such as flood control, water supply, irrigation, navigation, etc. which contribute in economic prosperity of a nation. However, there are some environmental and social concerns also associated mainly with large hydro projects, such as deforestation, rehabilitation, aquatic lives, sedimentation behind the dam etc [1-2].

III. Classification Of Hydroelectric Power Projects

The classification of hydropower projects is shown in Figure 1.

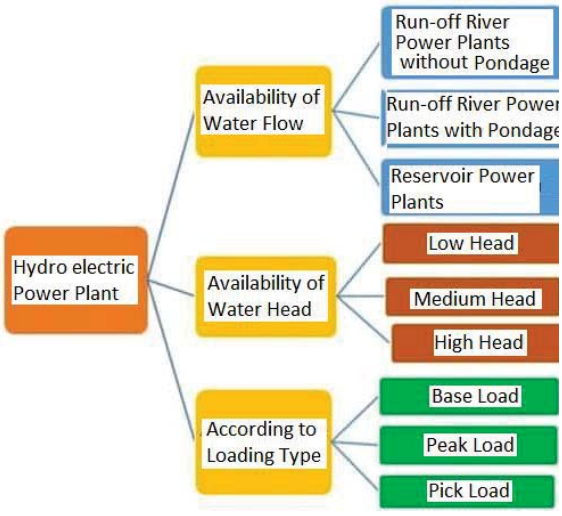

Fig. 1 Classification of hydroelectric power projects [3]

(a) Run-of-river projects

In a run-of-river project, there is no dam to store flowing water. However, in some cases a barrage is built to fulfil the water requirement due to load variation. Run-of-river plants may be located at the downstream of a canal fall or open flume. A stream's flow may also be diverted around a dam or fall.

A chronological development of hydropower is given in Table 1.

Table 1: Chronological development of hydropower [4]

Between 202 BC and 9 AD	Trip hammers powered by water wheel were used to grind the grains, break ore, and paper-making during Han Dynasty in China
1771	Richard Arkwright set up Cromford Mill in England's Derwent valley to spin cotton. It was one of the world's first factory systems used for economic growth
1827	French engineer Benoit Fourneyron developed the first version of reaction turbine, which was capable of producing around 6 HP
1849	British–American engineer James Francis developed the first modern hydro turbine, named after him. It is the most widely used turbine globally
1878	The first commercial Pelton Wheel was installed at Mayflower Mine, Nevada City, USA
1878	The world's first hydroelectric project was installed at Northumberland, England. It powered a single lamp in the Crag side country house
1882	Appleton hydro power plant, Wisconsin, USA was the first to supply power to private and commercial consumers
1891	The first three-phase hydroelectric power system was commissioned in Germany
1895	Australia launched the first publicly owned hydroelectric power plant in the Southern Hemisphere
1895	The Edward Dean Adams Power Plant, the world's largest hydroelectric with each generator output of 3.7 MW (5000 HP) development of the time, was built at Niagara Falls. The power system was built by WestinghouseElectric and Manufacturing Co. The power was transmitted 25 miles at 25 Hz using single wire
1897	2 × 65 kW hydroelectric project, the first in India, was set up in Sidropong valley, Darjeeling
1902	2 MW large hydro generating unit was set-up in Shivasamudram, Karnataka, India
1912	480 kW station, the first in China, was set-up in Shilongba, Yunnan province
1913	Austrian professor Viktor Kaplan developed a turbine. It was named 'Kaplan' turbine. It is basically a propeller-type turbine with adjustable blades
1930	The first pumped-storage, reversible unit was commissioned in USA. Water was pumped from the Housatonic River to 230 feet high upper reservoir
1936	1,345 MW Hoover Dam on Colorado River, USA, was the largest hydroelectric power plant of the time in the world
1942	The 1,974 MW, Grand Coulee Dam (now 6,480 MW) was the world's largest capacity hydropower project of the time located in Washington, USA
1984	12,600 MW, Itaipu Dam on Parana River dividing Brazil and Paraguay (since been enlarged and upgraded to 14,000 MW) The power plant in Brazil has 10× 700 MW, 60 Hz generating units The power plant in Paraguay has 10× 700 MW, 50 Hz generating units
1998	1883 m, highest head and most powerful 3x423 MW, 5 jet, Pelton turbines in operation at Bieudron Hydroelectric Power Station, Switzerland
2008	Three Gorges Dam, China is the highest capacity hydropower project equipped with 32 ×700 MW + 2 × 50 MW generating units
2013	At 770 MW, it is the highest capacity Francis turbine commissioned for the Xiluoda Dam Hydropower Project, China
2016	At 230 MW, it is the highest capacity Kaplan turbine with 8.6 m diameter runner for Tocoma Dam Power Plant, Venezuela
2019	India crossed 50,000 MW installed hydroelectric power capacity in 2019 and reached 51,162 MW by July 2021 (large and small hydro combined)

The power plant operates as per the available flows, otherwise power generation is lost. The discharge varies on day-to-day basis as per natural flow of water from the catchment area; the characteristics of which depend on the hydrological features. Figure 2 shows 2,620 MW Chief Joseph, USA, the largest capacity run-of-river hydropower project of the world.

Fig. 2 Chief Joseph, the world's largest run-of-the-river hydroelectric power project [5].

The possibility of installing mini-micro units in large size pipes (above 2 m) for supplying water in mega cities needs to be explored. It will recover some energy consumed in pumping water for long distance supply.

(b) Storage type

The dam is built across the river to store the flowing water of a river. In a hydropower project, water is released from the reservoir as follows:

i. Normal operation: Water is released through the penstock to rotate turbine runner which is coupled to the generator for power generation.
ii. Excess water: In case of excessive water inflows or flood, the release of huge quantity of water becomes inevitable for safety of dam by opening the gates of a dam. The gates may be partially or fully opened. The opening of the number of gates depends on the quantum of water to be released.

(c) Pumped-storage projects

It is well known that power demand reduces substantially during late night and starts increasing from morning. The power demand is also less during holidays. In a pumped-storage project, a lower reservoir is also built on downstream of dam. The surplus power in the grid is utilized in pumping the water from a lower reservoir to an upper reservoir and reuse the same for power generation. However, in order to meet load demand during the day and evening peaks, the power plant is operated in a generation mode and supply power to the grid.

The pumped-storage project is normally equipped with reversible units, that operate as turbine-generator in one direction of rotation and as pump-motor in the reverse direction. These two modes of operation are given here:

i. Generation mode: It operates as a conventional turbine generator.
ii. Pumping mode: in this mode of operation, the turbine acts as a pump and the generator as a motor in the reverse direction of rotation. The motor draws power from the utility grid to drive the pump. The water is pumped to the upper reservoir using the same water conductor system.

In the reversible units, Francis turbines are best suited for operation in both the modes as turbine as well as pump. The advent of variable speed technology paved the way for operation at higher efficiencies. The reversible units operate in synchronism with the grid frequency in the generation mode. The pump is designed to operate at its peak efficiency at rated grid frequency (50 Hz in India) in the pumping mode. An illustrative of pumped-storage project with underground power house is shown in Figure 3.

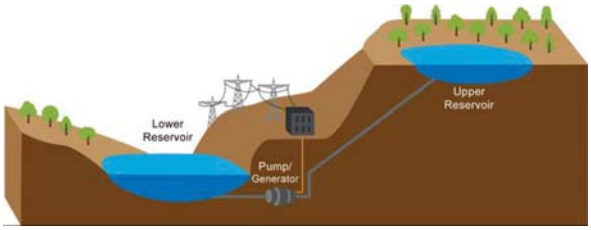

Fig. 3 An illustrative underground pumped-storage station [6]

Looking to the recent planning of large capacity solar power plants, the possibility to use this solar power for pumped storage plants needs to be explored. In other words, it will be a sort of storage of solar energy which can be used during peak hours.

IV. Working Of Power Plant

Figure 4 shows a typical layout of a hydroelectric power project and its basic components.

(a) Dam and Reservoir: The dam is built across a river to store water at a height. The dam forms a reservoir behind it. The head and quantity of stored water in reservoir determine the potential energy of stored water.

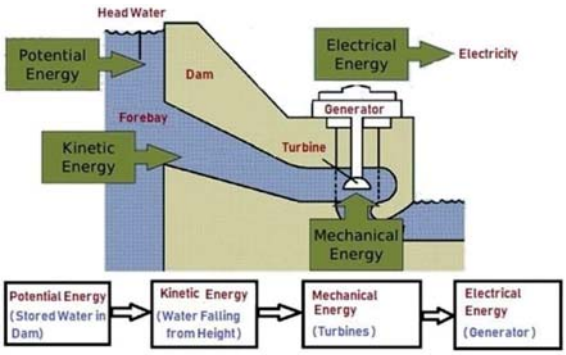

Fig. 4 Typical layout of a hydroelectric power project [4]

(b) Flow Control Gate/Valve: Water from the higher elevation flows through the penstock to rotate the turbine runner. The flow of water is controlled (only full open/close and emergency shut down) by the gate provided at the upper end of the penstock, called penstock gate or by a main inlet valve installed inside power house before the turbine. The quantity of water flowing through the penstock depends on the opening of penstock gate/main inlet valve.

(c) Penstock: A penstock is generally made of steel for high heads. However, concrete or fiber-reinforced composites penstocks are also used for low head projects. Potential energy of water is converted into kinetic energy as due to gravity, water flows down through the penstock.

(d) Water Turbine: Water from the penstock rotates the turbine runner which is coupled to the generator shaft through turbine shaft. Kinetic energy of the water drives the turbine and the generator mechanically coupled to it through shaft. There are two main types of water turbines; (i) Impulse turbine and (ii) Reaction turbine. Impulse turbines are used for large heads whereas reaction turbines are used for medium and low heads.

Gross head of a reaction turbine = Reservoir water level – tail water level

Gross head of an impulse turbine = Reservoir water level – center line of the runner

(e) Surge Tank: It is provided in case of a very long penstock. When there is sudden reduction in load on the turbine, say due to load throw-off, the gate/valve of the turbine close to stop/ reduce the water flow. This causes water pressure to increase abnormally (called water hammer) which is prevented by a surge tank, in which the water level rises to reduce the pressure. However, when the gates are suddenly opened to meet increased load, the surge tank supplies the available excess water.

(f) Generator: A generator converts the mechanical energy into the electrical energy. Flexibility is a great advantage with the synchronous generators which can be taken to full load in two minutes. Further, a synchronous generator has capability to operate at lagging, leading or unity power factor by adjusting its excitation. This is the reason that synchronous generators are used in hydro, thermal as well as nuclear power plants.

The generator shaft is coupled to the turbine shaft. When the turbine runner is rotated, it drives the generator and electricity is generated. The generated electrical power is supplied to the step-up transformer for the high voltage power transmission.

(g) Operation in synchronism: The generator has to operate in synchronism with the utility grid i.e., generated voltage and its frequency should match with those of the utility grid. The frequency matching is achieved through governor whereas the voltage matching is done by excitation system.

(h) Governor: The rotational speed of turbine is directly proportional to the frequency of grid-connected synchronous generator used in the hydro/thermal/nuclear power plants. The frequency of utility grid is compared with the turbine speed and as per the difference, the water flow is regulated to increase/reduce the water flow through the turbine.

(i) Excitation system: The utility grid voltage is sensed and compared with the generator voltage. The generated voltage is adjusted to match with the grid voltage by regulating the field current through the excitation system.

V. Global Scenario Of Hydropower

On September 30, 1882, the world's first commercial hydroelectric power plant came into operation on Fox river in Appleton, Wisconsin. The Appleton paper manufacturer H.J. Rogers was inspired by Thomas Edison's plan for installing an electric power-generating station in New York. He later named the power plant as Appleton Edison Light Company. The power plant generated enough electricity to light Rogers' home, the power plant itself, and a nearby building.

There are over 150 countries which generate hydroelectric power, although around 50% of it is generated by just 4 countries: China, Brazil, Canada, and the United States. Environment friendly and low-cost hydropower plays key role in boosting the economy of these countries. The global installed hydropower capacity and leading countries are given in Table 2.

Table 2: Leading countries in installed hydropower capacity as on December 2020 [5].

S. No.	Country	Capacity, GW
1	China	370.2
2	Brazil	109.1
3	USA	102.0
4	Canada	82.0
5	India	50.5
6	Japan	49.9
7	Russia	49.9
8	Norway	33.0
9	Turkey	31.0
10	France	25.5

The global hydropower generation and break-up of installed power capacity as of December 2020 are shown in Figure 5.

Fig. 5 Leading countries in installed hydropower capacity [7]

Globally, the large-capacity conventional hydroelectric power projects are listed in Table 3.

Table 3: World-wide large-capacity conventional hydroelectric projects [4].

Station	River	No. × capacity (MW)	Total capacity (MW)	First unit commissioning
Three Gorges, China	Yangtze	32 × 700 + 2 × 50	22,500	2008
Itaipu, Brazil/Paraguay	Parana	20 × 700	14,000	1984
Xiluodu Dam, China	Jinsha	18 × 770	13,860	2013
Guri, Venezuela	Caroni	10 × 730 + 4 × 180 + 3 × 400 + 3 × 225 + 1 × 340	10,235	1978
Tucuruí, Brazil	Tocantins	12 × 350 + 11 × 375 + 2 × 22.5	8,370	1984
Grand Coulee, USA	Columbia	27 × 252	6,809	1942
Xiangjiaba, China	Jinsha	8 × 812 + 8 × 800	6,448	2012
Longtan, China	Hongshui	9 × 714	6,426	2009
Sayano-Shushenskaya, Russia	Yenisei	10 × 640	6,400	1978-85
Krasnoyarsk, Russia	Yenisey	12 × 500	6,000	1972

Table 4: Large capacity pumped-storage projects [4]

Station	Country	No. × Capacity (MW)	Capacity (MW)	Commissioning
Bath County	United States	6 × 480/500.5	3,003	1985
Huizhou	China	8 × 300/312	2,448	1994-2000
Guangdong	China	8 × 300	2,400	1994-2000
Okutataragi	Japan	4 × 483	1,932	1974
Ludington	United States	6 × 362	1,872	1973

Table 5: Large capacity run-of-river projects [4]

Station	Country	Capacity (MW)
Chief Joseph	United States	2,620
John Day	United States	2,160
Beauharnois	Canada	1,903
The Dalles	United States	1,779.8
Inga dams	Democratic Republic of Congo	1,775

VI. Indian Hydropower Scenario

The first power project in India was a 2 × 65 kW hydropower plant commissioned on 10 November 1897 in Sidrapong valley, Darjeeling by Darjeeling Electric Supply Co. Later, it was merged with the West Bengal State Electricity Board in 1978. The project is still maintained as heritage site.

As of 31 July 2021, India's total installed hydropower capacity (large and small) was 51162 MW against the estimated potential of 148,700 MW at 60% load factor. In addition, for pumped-storage schemes, 56 sites have been identified with the total installed power potential of 94,000 MW.

The hydropower projects are developed by government sector, state utilities, joint sector and private sector. The examples of government sector are Karnataka Power Corporation Limited (KPCL), state irrigation departments etc. There are some joint sector projects also like NHDC Limited which is a joint venture between NHPC Limited in central sector and Madhya Pradesh State Government. NHDC has executed 1000 MW Indira Sagar and 520 MW Omkareshwar hydropower Projects on river Narmada in Madhya Pradesh.

The public sector has a major share in India's hydroelectric-installed power capacity. The public sector companies involved in developing hydroelectric power are mainly:

i. Bhakra Beas Management Board (BBMB)
ii. National Hydroelectric Power Corporation (NHPC)
iii. Northeast Electric Power Company (NEEPCO)
iv. Satluj Jal Vidyut Nigam Limited (SJVNL)
v. Tehri Hydro Development Corporation (THDC India Ltd.)
vi. NTPC-Hydro
vii. Narmada Hydropower Development Corporation (NHDC Ltd.)

The private sector is also contributing in the development of hydroelectric power mainly in the Himalayan ranges, the northeast and to some extent in other parts of the country. Indian companies have also executed hydropower projects in Bhutan, Nepal, Afghanistan, among others. Some of the players in the private sector are Jaiprakash Associates Limited, Tata Power, Greenco, Lanco, LNJ Group, GVK Group etc. The large-capacity hydroelectric power projects in India are listed in Table 6.

Table 6: Conventional large Capacity hydroelectric power projects [4]

Project	State	River	Capacity (MW)	Remarks
Naphta Jhakri	Himachal Pradesh	Satluj	6 × 250 = 1500	SJVN Ltd.
Bhakra Nangal	Himachal Pradesh	Satluj	5 × 157 = 785	Right bank/BBMB
			5 × 108 = 540	Left bank/BBMB
Koyna St.-IV	Maharashtra	Koyna	4 × 250 = 1000	MAHAGENCO
Karcham- Wangtoo	Himachal Pradesh	Satluj	4 × 250 = 1000	Run of the river JSW Group
Indira Sagar	Madhya Pradesh	Narmada	8 × 125 = 1000	NHDC
Dehar	Himachal Pradesh	Satluj	6 × 165 = 990	BBMB
Kalinadi (Nagjhari)	Karnataka	Kali	6 × 150 = 900	KPCL
Srisailam (Right)	Andhra Pradesh	Krishna	6 × 150 = 900	APGENCO
Koldam	Himachal Pradesh	Satluj	4 × 200 = 800	NTPC
Parbati-II	Himachal Pradesh	Parbati	4 × 200 = 800	NHPC
Idduki Dam	Kerala	Periyar	6 × 130 = 780	KSEB
Nagarjun Sagar	Telangana	Krishna	7 × 100 = 700	APGENCO

(a) Pumped storage projects

In the pumped storage projects, mostly the Francis turbines are used which act as pumps in the reverse direction. However, Deriaz pump turbines are used in Kadana pumped-storage plant. The pumped-storage projects in India are given in Table 7.

Table 7: Pumped-storage projects in India [4]

Project	State	River	Capacity (MW)
Sardar Sarovar	Gujarat	Narmada	6 x 200 = 1,200
Tehri	Uttarakhand	Bhagirathi	4 x 250 = 1,000
Purulia	Bengal	Kistobazar Nallah	4 x 225 = 900
Srisailam Left Bank	Andhra Pradesh	Krishna	6 x 150 = 900
Nagarjunsagar Tail Pond	Andhra Pradesh	Krishna	7 x 100 = 600
Kadamparai	Tamil Nadu	Aliyar	4 x 100 = 400
Kadana	Gujarat	Mahi	4 x 60 = 240
Bhira	Maharashtra	Kundalika	1 x 150 =150
Ghatgar	Maharashtra	Pravara	1 x 125 = 125
Panchet (DCV)	Jharkhand	Damodar	1 x 40 = 40
Paithan (Jayakwadi Dam)	Maharashtra	Godavari	1 x 12 = 12
Ujjaini	Maharashtra	Bhima	1 x 12 = 12

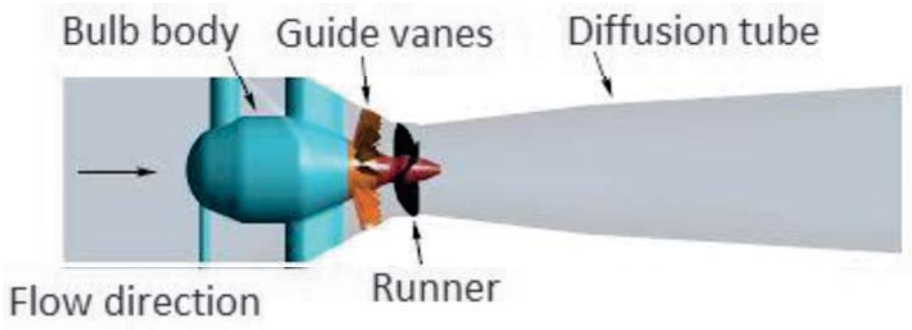

Fig. 6 Bulb turbines in the water passage [6]

(b) Bulb turbine projects

There is a special class of turbines suitable for low head and high discharge. In this arrangement, the turbine and generator are installed inside the bulb shaped waterproof steel housing. The bulb itself is installed in the water passage and flowing water rotates the turbine runner. Figure 6 shows the bulb turbine placed in the water passage.

The hydropower projects in India equipped with bulb turbines are given in Table 8.

Table 8: Bulb turbine projects in India [4]

Project	*State*	*No. × capacity (MW)*	*Capacity (MW)*	*Commissioning*
Sone Link Canal	Bihar	6 × 1.732	10.4	1992
Teesta Canal Fall-I	Bengal	3 × 7.5	22.5	1999
Narayanpur LBC	Karnataka	2 × 5.8	12	
Lower Jurala	Telangana	6 × 40	240	2013–16
Lower Mettur Barrage-III	Tamil Nadu	2 × 15	30	1988
Eastern Gandak	Bihar	3 × 5	15	1997
Western Yamuna Canal –Phase-I	Haryana	2 × 8	16	1989
Western Yamuna Canal –Phase-II	Haryana	2 × 7.2	12	2004

VII. CONCLUSION

In this paper, the challenges imposed by climate change and the role of hydropower in mitigating the effects of climate change have been discussed. An overview of hydropower development in India and the world is presented along with the list of different types of hydropower projects. With the fast-growing population, to make provision of water to all is challenging and in this regard hydro projects with dam-storage play crucial role in managing the water resource for its utilization for drinking, irrigation (India built Afghan-India Friendship Dam, formerly Salma Dam to store water for irrigation and drinking purposes), industries, and may be power generation, if needed and found techno-economically viable. Lastly whether the climate calamity can be converted into boon by making use of storm, high floods to some extent; needs to be explored/examined.

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Energy Management Principles as applied for Energy Audit of Air-conditioning Systems

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Abstract- *The energy management is an important activity in all sectors of economy including domestic, agricultural, commercial and industrial sectors. It involves managing energy requirements in such a way that the least amount of energy is needed to complete a task while using the right quality of energy. There are certain common basic principles which are applied to ensure that these objectives are met. The author has tried to apply these principles for conducting the energy audit of air-conditioning systems to achieve the objectives of energy management.*

Keywords: Energy Audit, Air Conditioning systems, Energy Management.

I. Principles of Energy Management

The energy management involves the utilization of the minimum quantity of energy required for the task at an appropriate quality, neither better nor worse than needed. At the most elementary level, energy management may be thought of as **'task energy use' e.g. the provision of as much energy as is needed, when it is needed, where it is needed, and with the right quality.**

There are certain basic approaches or general principles which can be applied in a wide variety of applications.

Table 1 summarizes some general principles which experience has shown are applicable to a wide variety of situations.

Table 1: Fundamental Principles of Energy Management [1-2]

Sl. No	Principle
1	Review historical energy use (review of historical data and current practices)
2	Housekeeping and maintenance
3	Analysis of energy use (engineering analysis, computer simulation)
4	More efficient equipment
5	More efficient process
6	Energy containment (heat recovery and waste reduction)
7	Material substitution
8	Material and resources economy (scrap recovery, salvage and recycle)
9	Material quality selection (material purity and properties)
10	Aggregation of energy uses
11	Cascade of energy use
12	Renewable energy sources (energy from or fuel substitution)
13	Energy conversion
14	Energy storage
15	Economic evaluation (cost benefit, rate of return, life-cycle costing)

II. AIR-CONDITIONING SYSTEMS

Air-conditioning involves simultaneous control of Air purity and filtration, Air movement, Dry-bulb temperature and Relative humidity while ensuring low Noise and vibration, highest Energy efficiency, and Fire safety. There are different types of systems as shown in the Figure 1 to achieve the above performance.

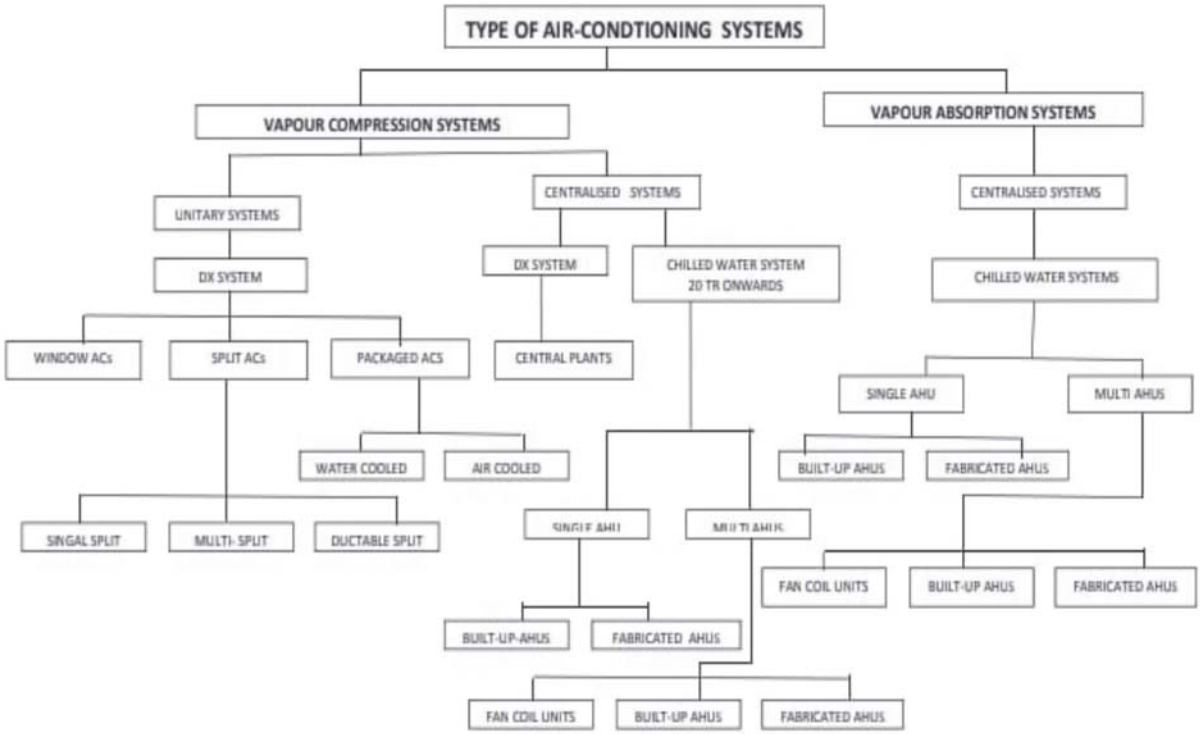

Fig. 1 Types of Air Conditioning Systems

III. APPLICATION OF ENERGY MANAGEMENT PRINCIPLES IN AIR-CONDITIONING SYSTEMS

(a) Review of Historical Use & Current Practices

The first principle is to review historical energy use.

Applying this principle, we could identify many energy saving measures while conducting the energy audit of Air-conditioning Systems. One example is given below:

CASE STUDY: *Air-conditioning system of a BSNL Telephone Exchange Building*

The building located at Bhopal had many systems of different types including Window ACs, Split ACs, Direct Expansion (DX) systems and a Chilled Water System purchased at different times. All were under use independent of each other catering to different office rooms, telephone exchange equipment, and different sections within the building premises.

We did the heat load calculations and found that the Chilled Water System had extra capacity as it was highly over-designed. The extra capacity was good enough for the part of the building which was provided with a DX system.

Thus, an energy saving idea emerged that the DX coil of the Air-Handling Unit (AHU) could be replaced with a Chilled Water Coil. After evaluating the parameters related to coil selection, it was concluded that there was no technical hitch. This way, we could discontinue the use of the DX plant. An overall saving achieved was more than 65,000 kWh per year and needed net capital investment.

(b) Improvement of Housekeeping and Maintenance

In many places, it is a common sight to find that the housekeeping and maintenance points being neglected or not attended well. The energy savings achievable through these measures can be 5-10 % of the total energy consumption of the AC system. For Air-conditioning systems, it involves regular cleaning of filters, coils, ducts, and functioning of controls.

(c) Analysis of Energy Use

Analysis of energy use is done to establish what happens if a parameter change (reduce flow by 50%), or to simulate operations (computer models of building or process energy use).

CASE STUDY: Analysis of energy use in *Walk-in coolers*

There was a small-scale dairy unit having a few Walk-in coolers provided to keep basic raw ingredients like 'Mawa' stored at certain temperature ranges. Once, the temperature reaches, the compressor was to trip however, the circulating fan inside the cooler meant for circulation of air was designed to continue running for uniform cooling of the stored products.

This was not only causing electricity consumption by the circulating fans but was also adding heat load inside. Thus, the compressor was getting-ON more frequently.

We did an analysis and came to the conclusion that considering the size of the cooler, the natural convection current would suffice. We then arranged to ensure that the fans also get switched off when the compressor trips and observed for few days. There was no adverse effect on the raw materials as the temperature was being still quite uniform. The cycle time increased and the total time for which the compressor was running reduced by 30%. Thus, the energy was saved without affecting the performance.

(d) More energy efficient equipment

Many types of industrial and residential/commercial equipment are now rated or labeled in terms of their efficiency. However, there are wide variations among different manufacturers depending on size, quality, capacity and initial cost.

Replacement of existing inefficient equipment like fans, pumps, lighting systems, ACs, Transformers etc. is very common. We need to do it judiciously after establishing the efficiency of the existing system correctly and considering the system as a whole and not the equipment in isolation. The overall system design should be energy efficient.

The standalone equipment or appliances like fans, ACs, Refrigerators, can be replaced with latest super energy efficient equipment /appliances. These incorporate not only the full load efficiency but also provide flexibility of part load efficient operations.

CASE STUDY: *Replacement of Standard Ceiling Fans with Super energy efficient ceiling fans*

i. Average power consumption by use at different speeds for existing fans= 60 Watts
ii. Average power consumption by use at different speeds for Super energy efficient fans as demonstrated for the same air quantity = 12 Watts
iii. Average hours of productive use per year = 300 days X 8 hours = 2400 hours
iv. Average hours of unproductive use (by housekeeping staff / unnecessary running or at high speeds) = 600hrs

It was proposed to replace existing fans which are used for more than 8 hours per day with Super energy efficient Fans. There were 100 such fans installed in various areas. The fans rarely used were not to be replaced. It is also proposed that the old fans may either be installed in places where these are rarely used or sold to employees to put them in places where these are used occasionally.

The super energy efficient fans consume only 5-7 W power at lowest speed and 28-35 W power at full speed as against conventional fans which consume 40-80W for the corresponding speeds and air flow. The power consumption at intermediate speeds is 9 W, 12 W and 18 W. The reduction in electricity bills is due to the use of Brushless Direct Current (BLDC) motor as well as timer and sleep mode. Investment made in purchase of Super energy efficient fans gives the buyer more than 50% returns and payback period of 2 to 3 years depending on tariff/hours of use etc. The remote provides convenience of use at different speeds while Timer and Sleep mode help in further energy savings and increased comfort as the fan automatically reduces the speed in sleep mode and stops as per pre-set timing.

Biggest energy savings are possible in Air-conditioning systems if the Super energy efficient fans are used in Air-conditioned premises by setting the thermostat at higher temperatures of 28-29 Degree C. All energy auditors must recommend this measure which is a very easily implementable low hanging fruit.

(e) More efficient processes

This idea of using more energy efficient process for Air-condoning systems include alternatives to refrigerant based cooling systems like Direct-Indirect Evaporative Cooling systems, Natural cooling systems, Hybrid systems etc. In many applications, especially for comfort cooling application systems, we can do that.

(f) Energy Containment

Energy containment seeks to confine energy, reduce losses and recover heat. For Air-conditioning applications, this principle is applied to minimize hot air ingress and cold air leakages, insulation of ducts, pipes, heat recovery etc.

(g) Material Substitution

For Air-conditioning systems, this principle is applied during manufacture of the equipment and selection of pipe/duct/insulation materials which has lowest embedded energy consumption during manufacture, installation and maintenance.

(h) Material & Resources Economy

For Air-conditioning Systems, the materials for pipes, ducts, supporting structures, cooling towers, etc. are selected in such a way that these have maximum reuse, and recyclable components with least waste and need for resources like water and land etc.

(i) Materials Quality

Materials quality selection is extremely important, since unnecessary quality almost always means higher cost and often means greater energy use. During the energy audit, this aspect may also be observed and included in the report.

(j) Aggregation of energy use

Aggregation of energy helps to save energy used for transportation of materials as well as to reduce losses.

This principle is actually applicable at the design stage; however, the energy auditor may apply it during the audit and include it in the report [3].

(k) Cascade of energy use

Proper time sequencing of operations can also reduce energy use, for example by using temperatures generated by one step of the process to provide preheating needed by another step.

This principle can be applied in Air-conditioning systems for use of waste heat from other processes, hot condense water return for reheating to maintain Relative Humidity instead of using electrical heaters.

(l) Renewable energy sources

For several applications such as low-grade heating or drying, solar thermal systems like Solar Water Heaters/ Solar Air dryers can be used for 300 days in a year. Biomass briquettes can be used for direct firing in Boilers.

Solar PV powered air-conditioners and Solar Thermal based Vapor based air-conditioning systems are the examples [4].

(m) Energy conversion

In some of the applications, the form of energy used can be changed to another form to save over all energy.

For Air-conditioning systems, this principle can be used to avoid use of high-quality energy like electricity with a lower quality energy or waste wherever possible.

(n) Energy storage

Thermal Energy Storage systems involve storing of thermal energy to meet peak demand.

The applications for air-conditioning systems include the production of ice, chilled water, or eutectic solution at night, or hot water which is then used to cool / heat environments during the day.

(o) Economic Evaluation

Economic evaluation helps in prioritizing the energy saving measures for the best overall energy efficiency gains.

IV. Conclusion

Implementation of the energy management principles can be done right from the selection of materials during manufacturing, equipment sizing and selection to system integration, operation and maintenance.

For new projects, the plant designers can incorporate these principles to ensure the most energy efficient designs for the life of the equipment and processes.

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A Detailed Study of Two Different Airfoils on Flight Performance of MAV of Same Physical Dimension

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Abstract— *The paper presents a study of micro air vehicles (MAVs) with wingspans of 20 cm with two different airfoil configurations. MAVs have a vast potential application in both military and civilian areas. These MAVs are fully autonomous and supply real-time data. The paper focuses on two different designs of the MAVs one being N22 airfoil and the other a flat plate with similar dimension. As designed, the MAV would fly in a low Reynolds-number regime at airspeeds of 15 & 20 m/sec. Propulsion would be provided by an electric motor with an advanced lithium polymer battery, because of the close coupling between vehicle elements, system integration would be a significant challenge, requiring tight packaging and multifunction components to meet mass limitations and Centre of Gravity (C.G) balancing. These MAVs are feasible and within a couple of years of technology development in key areas including sensors, propulsion, Aerodynamics, and packaging these would be easily available to the users at affordable prices. The paper finally compares the flight performance of the two configurations.*

Keywords— Airfoil, CFD, MAV, Flight Performance, Endurance, Climb, Lift, Drag.

I. Introduction

To carryout outdoor missions a fixed-wing MAV is suitable due to its high forward flight efficiency [1-3]. Most modern MAVs are designed to be smaller than conventional UAVs, which are hand launched units, able to be transported and deployed by one individual, which would be an impossible scenario with larger UAVs [4-7]. Potential capabilities for this fixed wing MAV is that uses a data link, navigates independently and carries multiple sensors made up of organic materials too. Because of their small size and low power, such MAVs would be quite covert [8-11]. In addition, exploiting micro-fabrication technology would make possible the production in large quantities of MAVs at low unit cost. The micro -fabrication technology is also used in double aero shape irregular polygon slotted microstrip antenna for WI-FI applications [12-13].

II. Methodology

The paper focuses on the comparison of a Micro MAV (MB200) with N22 airfoil and a flat plate (FP) wing for a 20cm MAV rather than analysis and algorithm studies of the MAVs controller. The two configurations will have the same set of propulsion device, sensors and controller. Hence the discussion will be restricted in the area of optimization for application examples.

Table 1: Air foil data for MB and Flat Plate Configurations

MB 200		Flat plate	
Tip	0.10501	Tip	0.09
Root	0.17000	Root	0.14
Lambda	0.61771	Lambda	0.64286
MAC	0.140068	MAC	0.116812
C.G(X)	0.057	C.G(X)	0.054
AR	1.4	AR	1.3

III. Experimental methodology

CFD data is generated for 15m/s and 20m/s velocity at identical fluid properties. The aim of this paper is to compare the CFD data of FP and MB 200 and calculate the endurance and compare it with flight test data.

Table 2: Fluid Properties and Unit

Fluid Properties		Unit
Alt	920	m
P	90,752	Pa
R	1.12041	kg/m3
M	1.76E-05	kg/m-s
N	1.5709E-05	m2/s

Endurance is calculated by the current rating of the avionics. Current consumption of every component is estimated and summed up to find total current consumption for a cruise flight and hence estimate the endurance.

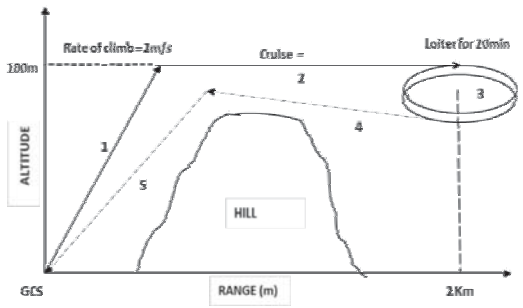

Fig. 1 Mission Profile

To calculate endurance the current drawn by individual avionic component is estimated at each flight condition i.e., take off, cruise, and landing.

Thrust produced by the motor, can be estimated from the static motor test data with the amount of current drawn from the motor and then extrapolated to dynamic results by keeping a margin of 33%.

Table 3: Static Test of motor

M: HK1612 8g , Prop : GWS 5x3, ESC : Turnigy :6A						
Throttle (%)	Voltage (V)	Current (A)	Power (W)	RPM	Thrust (g)	Efficiency (g/W)
5	8.49	0.12	1.0	3250	7.1	6.97
10	8.48	0.38	3.2	5800	23.5	7.29
15	8.47	0.72	6.1	7550	41.6	6.82
20	8.46	1.08	9.1	8775	56.7	6.21
25	8.45	1.49	12.6	9950	71.4	5.67
30	8.43	1.9	16.0	10975	86.8	5.42
35	8.42	2.25	18.9	11725	101.1	5.34
40	8.41	2.65	22.3	12550	116.4	5.22
45	8.4	3.09	26.0	13300	132.3	5.10
50	8.39	3.36	28.2	13800	142.8	5.07
55	8.38	3.69	30.9	14400	153.3	4.96
60	8.36	4.24	35.4	15300	173.2	4.89
65	8.34	5.16	43.0	16150	194.3	4.51
70	8.32	5.4	44.9	16625	206.9	4.61

By assuming the maximum l/d ratio for cruise flight from the CFD we can find the thrust required

$$Thrust = \frac{Wt}{l/d} \quad (1)$$

For a cruise, we know, at 15m/s wind speed

Lift = Weight (2)

Assuming l/d is 6.5 for cruise flight for MB 200

T = 130/6.5

=20 gms

Assuming l/d is 5.5 for cruise flight for FP

T= 130/ 5.5

=23.6 gms

For 25gms thrust throttle required for cruise condition is upto 15% consuming less than 0.38Amps of current for MB 200, For 23.6 gms thrust throttle required for cruise condition is around 15% consuming 0.38Amps of current for FP and in the same way, we assume at wind speed of 20m/s.

IV. Result & Discussion

AOA for cruise flight is 4 degrees generating a drag of about 27gms at 15m/s.

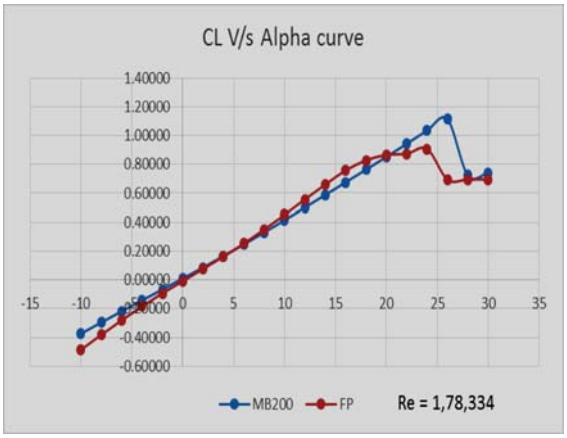

Fig. 2 CL vs Alpha Curve

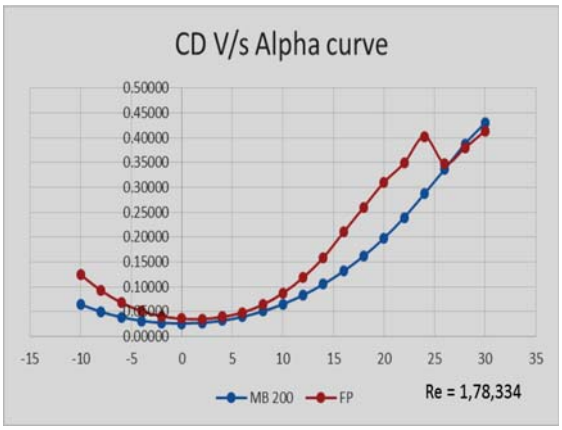

Fig. 3 CD vs Alpha Curve

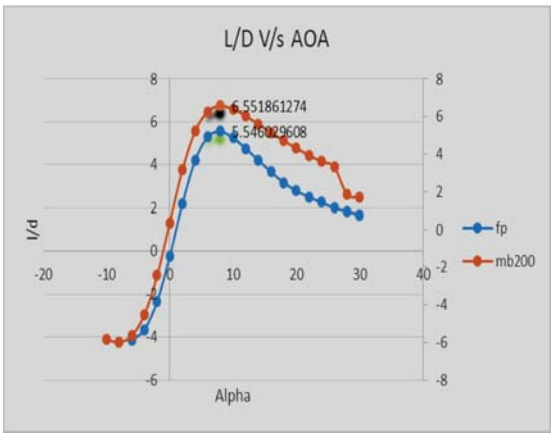

Fig. 4 L/D vs AOA

Max l/d is produced at an angle of attack of 8 degrees which would produce maximum endurance. At 8 degrees Cd is 0.06541 producing drag of 0.10 gms for FP and 0.0518 Cd drag of 0.0863gms for MB 200 at 15m/s Ground speed.

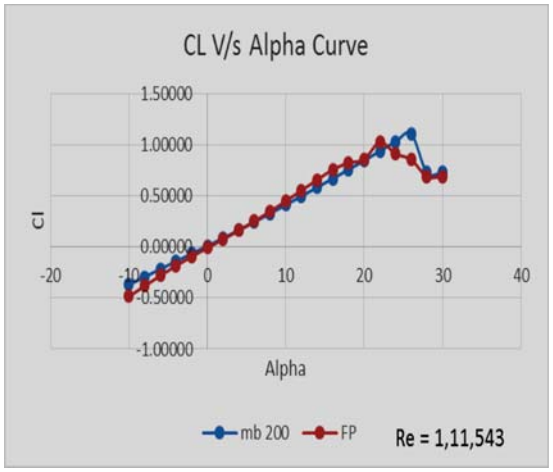

Fig. 5 CL vs Alpha Curve

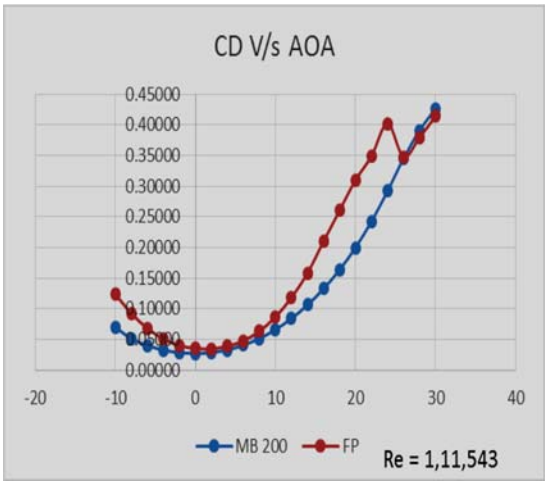

Fig. 6 CD vs AOA

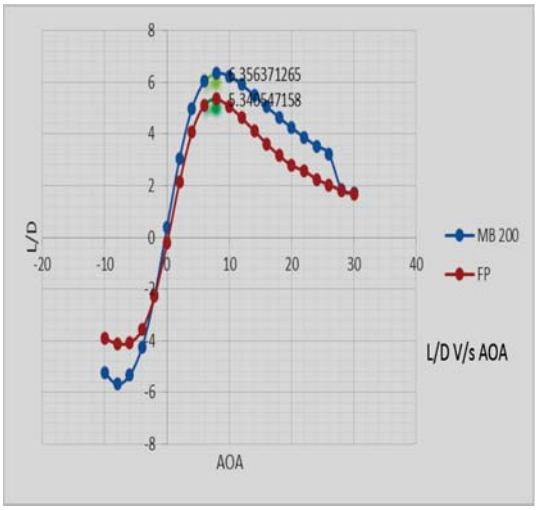

Fig. 7 L/D vs AOA

AOA for cruise flight is 10 degrees generating a drag of about 19 gms for MB200 and 23gms for FP where l/d is 6.2 and 5.0 which would reduce the efficiency of the MAV. At 10 degrees Cd is 0.0648 producing drag of 0.192 gms for FP and 0.0648 Cd drag of 0.192gms for MB 200.

V. Power Consumption

Power consumption for avionics is calculated and shown in below table.

Table 4: Avionics Current Consumption

CRUISE ALTITUDE	100.000	m					Mission Time	T=	12.105	min
CLIMB RATE	5.380	m/s								
DESENT RATE	10.000	m/s								
MOTOR CONSUMPTION							SERVO CONSUMPTION			
TAKE OFF							Voltage	4.800	6.000	V
Current Drawn	I1=	5.000	A	80%			Speed	0.120	0.100	sec
Time to takeoff	t1=	20.000	sec	0.333	min		Torque	0.700		Kg-cm
Total Current	C1=	26.000	mAh				Power=Torque x Angular Velocity			
							Power	P=	0.599	W
CRUISE							Assuming 80% efficiency			
Current Drawn	I2=	4.000	A	60%			Power	P=	0.479	W
Distance	Dis=	2.000	Km				Current I= P/V			
Velocity	V=	18.000	m/s				Current	C=	100.000	mA
Time to Cruise	t2=	111.111	sec	1.852	min		For 2/3 servos for mission time			
Total Current	C2=	123.000	mAh				No of Servos	No=	2.000	
							Total Current	Cservo=	40.354	mAh
LOITER										
Current Drawn	I3=	4.000	A	60%			AUTOPILOT CONSUMPTION			
Velocity	V=	18.000	m/s				Current Drawn	I=	100.000	mA
Time to Loiter	t3=	480.000	sec	8.000	min		Total Current	Cap=	20.000	mAh
Total Current	C3=	533.000	mAh							
							CAMERA CONSUMPTION video tx			
RETURN				60%			Current Drawn	I=	300.000	mA
Current Drawn	I4=	4.000	A				Total Current	Ccam=	61.000	mAh
Distance	Dis=	2.000	Km							
Velocity	V=	19.000	m/s							
Time to Return	t4=	105.263	sec	1.754	min		TOTAL CURRENT REQUIRED			
Total Current	C4=	117.000	mAh				Ctotal=Cmotor+Cservo+Cap+Ccam			
							TOTAL =	929.354		mAh
LANDING										
Current Drawn	I1=	2.500	A	40%						
Time to Landing	t1=	10.000	sec	0.167	min					
Total Current	C1=	7.000	mAh							
MOTOR CURRENT	Cmotor=	806.000	mAh							

Current required for the complete mission is calculated to around 900 mAh for 12-minute mission time.

VI. Experimental Results

Experiments were conducted in nil wind speeds but all parameters could not be simulated as per the requirement due to changes in weather conditions.

The data below shows that the two mav's were flown with same configurations and at same altitude of 30mts at semi-autonomous mode.

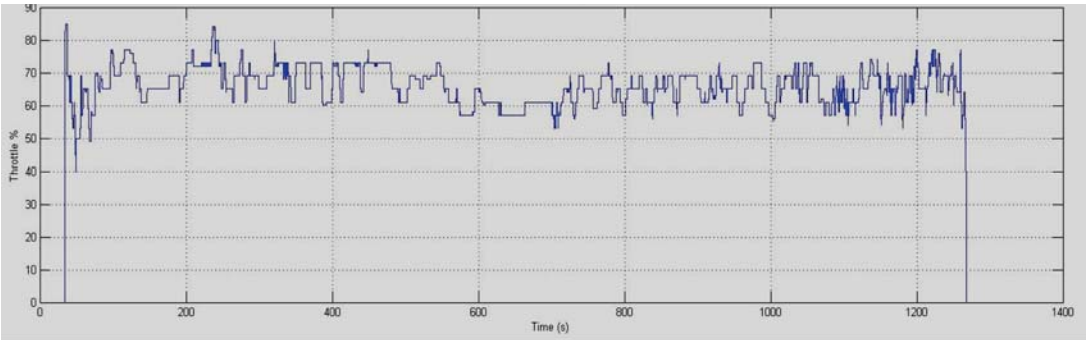

Fig. 8 Throttle vs Time for MB 200

The results indicated following observation for MB 200.

Throttle mean = 65.1483%.
Throttle median = 65%
Throttle range = 85%
Throttle mode = 65%

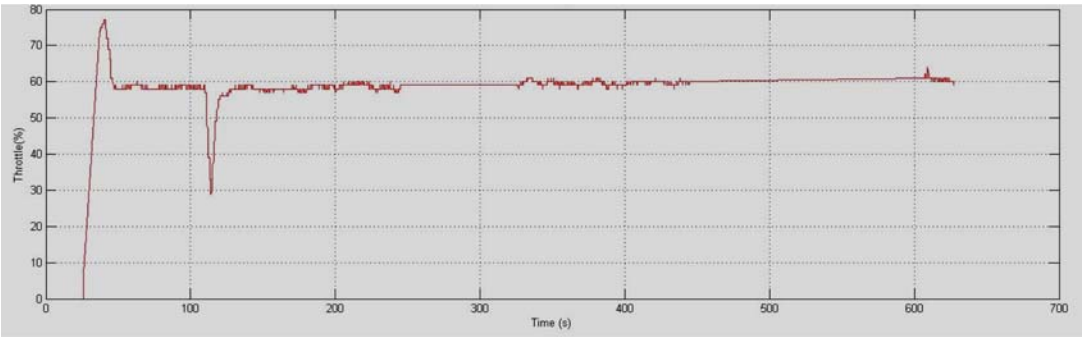

Fig. 9 Throttle vs Time for FP

The results indicated following observation for FP.

Throttle mean = 59.83%.
Throttle median = 60%
Throttle range = 85%
Throttle mode = 60%

VII. Conclusion

From the Computational results we can say that Cd MB200 is 0.0518 and for FP 0.06541 hence L/D is more for MB200 at 15m/s. Also, at 20m/s l/d is 6.2 for MB200 and 5.0 for FP. From the experimental data we can concur that flat plate has given less endurance than MB200.Few parameters such as atmospheric conditions are considered to be uncontrollable hence there can be a variation of 10%.

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Two New Recursive Approaches for Classification Based on Logic Gates

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Abstract- *There are so many methods of classification in literature but very few are based on properties of Boolean function. Autocorrelation is very important property of a given Boolean function. So, we have developed two methods to classify set of all Boolean functions based on Autocorrelation and Logic gates. We have used NSGA-II to get out results. Our method is novel and very efficient.*

Keywords: Boolean functions, Classifications, NSGA-II

I. INTRODUCTION

Cardinality of a set of Boolean functions for n-variables is too large. So, its very difficult to study all Boolean functions and check that given the Boolean function is cryptographically strong or not [1]. Classification of set of Boolean functions make this process very easy. So, Theoretical cryptographers always have great interest for any novel technique of classification. Classification methods are always welcomed by researcher because it makes representation of Boolean functions extremely easy, and Booleanfunction that belongs to same class will have same properties. In [2], Correia and Reis, have concentrated mainly three properties to classify the set of n-variable functions, first cardinality of functions in each class,second the cardinality of classes, and last the cardinality of NPN classes. In [3], authors classified Boolean functions into same cardinality equivalence classes based on permutation and combination. In [4], authors mentioned the procedure for selection of the representative from each class. Moreover in [5], authors divided set of Boolean functions into two groups namely linear and affine, and represented an algorithm to count the Boolean functions in each group. Some author tried to partition the whole set based on other properties of Boolean functions like Nonlinearity, resiliency etc. Methods listed in [6], and [3], are based on above properties. In [7], Rout n al. gave two new approaches, recursive and nonrecursive. They have partitioned the set of all Boolean functions such that exactly one affine function is representative of each class. This method was based on concatenation and recursive approach. In [8], two approaches are given, one is based on hamming distance and another on recursive. Above all, selection of representative is also animportant task. In [4], Golomb has also highlighted the procedure of selection of a representative function, with one member from each equivalence class. After analyzing all the work above, we formulated two approaches: recursive and evolutionary. In first approach, we started with 1-variable functions and went up to n-variables. For second approach, we applied NSGA-II and observed better results than previously listed results. Section-wise paper is arranged as follows: In Section 2, some denitions from literature are given. Section 3 gives a brief description evolutionary approach based on NSGA-II. In Section 4, we have developed two approaches, recursive and heuristic and classify the set of n-variables Boolean functions. Section 5 gives results and discussions of our work. In Section 6, we have concluded our work.

II. RELATED DEFINITIONS

(a) Boolean Function:

E_2 is a field of two elements and E^n is a n-dimensional vector space over E_2.

Boolean function f(x_1, . . .,), is a mapping from a set of all possible bit string of E^n to E_2. Collection of all possible Boolean function can be denoted by y and cardinality of this set is 2^{2^n}.

Number of 1's present in the string of f(x_1, . . . ,x_n), is called weight of Boolean function. If number of 1's are equal to the number of 0's in the string of f(x_1, . . . ,x_n), then Boolean function is called balanced Boolean function. A affine function is a Boolean function with algebraic degree one(at most). The n-variable affine function can be represent by

$f_{affine}(x) = a_1.x_1 \oplus a_2.x_2 \oplus a_3.x_3 \oplus \ldots \oplus a_n.x_n \oplus c$, where a_i and $c \in E_2$. For c = 0 above function is called linear.

(b) Hamming Distance: The Hamming distance between two functions f_1 and f_2 can be defined as the number of truth table positions in which the functions f_1 and f_2 distinct, we denote hamming distance by denoted by hd(f_1, f_2), So,

$$hd(f_1, f_2) = |\{x : f_1(x) \neq f_2(x)\}|,$$

where |.| represents the cardinality of the set.

(c) Walsh Hadamard Transform: By Walsh Hadamard Transform W_{HT}, we represent a Boolean functions with different manner. For a given $t \in E_2$, the W_{HT} of a f (Boolean functions) can be represented by $W_f(t)$ and defined by

$$(t) = \sum_{x \in E^n} (-1)^{f(x)+t.x}.$$

(d) Autocorrelation: The autocorrelation of a Boolean function represents an indication of the imbalance of all first order derivatives of a Boolean function and provides a measure of self similarity for Boolean function. The derivative of Boolean function f(x), taken with respect to a vector t, where x and t belongs to, can be defined as:

$$A_c(f) = \sum (-1)^{\{f(x)+f(x+h)\}},$$

A Boolean function f is considered to be good if $A_c(f)$ is small .

III. An Evolutionary Approach To Classify Boolean Functions

In this approach, we have described the developed method for classification. Our developed method can be explained into two parts (i) Formulation of objective function and (ii) Applications (Nondominating Sorting Genetic Algorithms-II)[4].

(a) Formulation of Objective function : We have used criteria of autocorrelation to classify the Boolean functions. We know that for n-variables Boolean function the autocorrelation can be given by

$$A_C(f) = \sum (-1)^{\{f(x)+f(x+h)\}},$$

and highest value of 2^n. As there are total 2^{2^n} Boolean functions for n-variable, hence these functions attain autocorrelation between zero to 2^n. So, we classified set of all Boolean functions based on their autocorrelation and found interesting results. Firstly, we formulated an objective function, and then, applied NSGA-II on this with proper parameter. Obtained results are listed in Table 1 and Table 2.

As per def (2.5), value of autocorrelation can be given by the following formula:

$$A_C(f) = \sum (-1)^{\{f(x)+f(x+h)\}},$$

We assign f_1 equal to autocorrelation and take as our objective function, As for cryptographically secure function, we need minimum value of autocorrelation so we seek to find minimum value of $A_c(f)$. Hence ourobjective functions is :

$$f_1 = (f),$$

So,

$$\min f_1 = \min \text{ of } (\sum (-1)^{\{f(x)+f(x+h)\}}),$$

To optimize the above objective function, we have applied optimization Technique (NSGAII).

(b) Application of optimization technique: After forming the objective function ($_1$), we have applied optimization technique at f_1. With help of proper parameters we have found some desired results and these results are shown in section 5. The proper parameters that we have taken for our optimization technique are listed in Tables 3 and Table 4. For 1- variable there are total 4 Boolean functions. When we have applied NSGA-II on our objective function, we got -2 value of autocorrelation for two Boolean functions and +2 value of autocorrelation for other two Boolean functions, hence we have placed all functions in two classes. So, there is only two classes for one variable functions. We have observed few similarities among the functions of a class, such as all odd weight functions belonged to one class whereas even weight functions belonged to another class. Another observation is that both classes have same number of Boolean functions. When we applied NSGA-II on objective function for 2-variables Boolean functions, we got two values of autocorrelation: zero and four. So, we placed all Boolean functions in two classes. Boolean functions belonging to a single class, have same autocorrelation. We have observed few similarities among the functions of a class, such as all odd weight functions belonged to one class whereas even weight functions belonged to another class. Another observation is that both classes have same number of Boolean functions. Similarly, we can classify Boolean functions for higher variables as well. Main feature of this method is that, corresponding to a value of autocorrelation, we found all possible Boolean functions in a single run with help of proper parameters. In Table 8, 9 and Table 10, we have shown sub classification of classes for all two variables.

The inferences drawn from the above classification method are as follows:

(i) Functions belong to a class have same autocorrelation.
(ii) No. of classes are very less.
(iii) Cardinality of each class is not necessarily same.
(iv) Functions belong to same class have similar pattern of bits.

Table 1: Obtained Results

Autocorrelation	Boolean function (class) Results by NSGA-II
-2	01, 10
+2	00, 11

Table 2: Obtained Results

Autocorrelation	Boolean function (class) Results by NSGA-II
0	0001, 0111, 1110, 1000, 0100, 0010, 1011, 1101
4	0000, 0011, 1100, 1010, 0110, 0101, 1111,1001

Table 3: Parameters (for 1-variables)

Count of generations	100
Count of population	16
probability1(of C_R)	0.777
probability2(of M_T)	0.1181
SRN*	0.9999
Total number of bits (for each variable)	1
Total objective functions	1
Constraints	0

SRN* - Seed Random Number

Table 4: Parameters (for 2-variables)

Count of generations	500
Count of population	256
probability1(of C_R)	0.776
probability2(of M_T)	0.1182
SRN*	0.9998
Total number of bits (for each variable)	1
Total objective functions	1
Constraints	0

IV. A Recursive Approach To Classify Boolean Functions

(a) In this method, we classify n-variable Boolean Function based on Logic gates. By applying Logic gates, we have found different patterns and for n –variables these patterns have (n-1) digits.

We have started with one variable functions. There are total four functions for 1 – variable. We have applied **OR** Logic Gates between its bits. For two Boolean functions (out of all four Boolean functions), When we applied OR gate on its bits, we got value 1 and for remaining two Boolean functions we got 0.So, We have putted them in two different classes (Given in Table 5).

Table 5: Different Classes

INPUT		OUTPUT
A	B	A **OR** B(A+B)
0	1	1
0	0	0
1	1	1
1	0	1

Explanation: Lets take one Boolean function for one variable say **00.** After Appling **OR GATE** on its bits (0+0 =0(modulo2)) and we got **0**. So, we have putted this Boolean function in first class. Similarly, we have applied OR gate on others Boolean functions and analysed the result. We got only two values 1 and 0. So, we have classified all 1- variables Boolean functions into two classes and each class has two Boolean functions(cardinality is equal for both classes).

(b) Now applying same OR GATE, we have classified all the Boolean functions for 2- variables. There aretotal 16 Boolean functions for 2-variables. We took all Boolean functions and applied OR Logic gate on all Boolean functions and got 4 different patterns. Based on thes e patterns we have putted them in 4 different classes. Boolean functions with same pattern (after applying OR Gate) belong to same class. So, based on this method we got total 4 classes and each class have equal number of Boolean functions.

Explanation: We have taken any one Boolean function of two variable say **1001** and applied **OR GATE** on its bits (two consecutive bits at a time). After applying OR GATES, we found pattern 11(1+0(first two bits), 0+1(last two bits)). After applying this process on all Boolean functions of 2- variables, we got total4 different patterns (11, 10, 01,00). So, we have constructed total 4 classes and each class have four Booleanfunction (equal number of Boolean functions). All classes are listed in Table 6.

(c) Based on same process, wehave classified all Boolean functions for 3 – variables. There are total 256 Boolean functions and after applying the above process, we got total 16 classes and each class has 16 Boolean functions. All the classesfor three variables are listed in Table7.

Explaination:

Consider a 3-variable Boolean Function be **01010011** on this function we apply four **OR** logic gates. First **OR** gate has been applied on first two digit position of Function. Second OR gate has been applied on 3rd and 4th position digits. Third OR gate has been applied on 5th and 6th position digits. Fourth OR gateis applied on 7th and 8th position digits. After applying these gates on Boolean function. we got pattern **1100**(0+1, 0+1, 0+0, 1+1). Hence we have putted this Boolean function under this pattern class.

(d) Similarly, we applied this procedure on all 256 Boolean Functions.

We have observed few similarities among the functions of a class, such as all odd weight functions belonged to one class whereas even weight functions belonged to another class. Another observation is that all classes have same number of Boolean functions. Similarly, we can classify Boolean functions for highervariables as well.

The inferences drawn from the above classification method are as follows:

(i) No. of classes are very less.
(ii) Cardinality of each class is same.
(iii) Functions belong to same class have similar pattern of bits.
(iv) As Boolean function and its complement have same properties So, both functions belong to same class.

Table 6: Obtained Results

Pattern	Boolean Functions	Number of Boolean Functions
0	00,11	2
1	01,10	2

Table 7: Obtained Results

Pattern	Boolean Functions	Number of Boolean Functions
00	0000, 1111, 0011, 1100	4
01	0010, 1101, 0001, 1110	4
10	1011, 0100, 1000, 0111	4
11	1010, 0101, 1001, 0110	4

Table 8. Obtained Results

Pattern	Boolean Functions	Number of Boolean Functions
0000	00110011, 00111100…..,…..	16
0010	00110111, 00111000,…..	16
0001	00110001, 00111110,…..	16
0011	00111010, 00110101,….	16
1010	01110111, 01111000,….	16
1011	01111010, 01110101,…..	16
1001	01110001, 01111110,….	16
1000	01110000, 01111111,…..	16
0101	00010001, 00011110,…	16
0110	00011011, 00010100,…	16
0100	00010000, 00011111,….	16
0111	00011010, 00010101,….	16
1100	10100000, 10101111,….	16
1111	10101010, 10100101,…..	16
1101	10101101, 10100010,….	16
1110	10101011, 10100100,….	16

Table 9. Sub classification of Class-I of 1-variable functions

No. of Boolean function	Hamming Distance (from the base Boolean function 00000000)	weight
1	0	0
1	2	2

Table 10: Sub classification of Class-I of 2-variable functions

No. of Boolean function	hamming Distance (from the base Boolean function 00000000)	weight
4	1	1
4	3	3

Table 11. Sub classification of Class-II of 2-variable functions

No. of Boolean function	hamming Distance (from the baseBoolean function 00000000)	weight
1	0	0
6	2	2
1	4	4

V. Results And Discussion

In Table 12 and Table 13 all Boolean Functions are shown.

After applying the method developed in Section 3 and in Section 4, we classified the Boolean functions. These functions belong to different classes, and same class functions have symmetry amongst them. The parameters taken to classify functions (by NSGA-II) for 1 and 2-variables are listed in Table 3, 4 respectively. Our methods are new and with less complexity as compared to [8,4,7,3].

VI. Conclusion

In this piece of work, we have partitioned the set of n-variables Boolean functions into equivalence classes of same size. Main characteristic of our first method is that, we need only one member of previous class to define whole class. Classification have been done by two different approaches. Our methods are efficient and less complicated. In evolutionary approach method, we have found all possible results in single run (for each n-variables) only. This is the main characteristic of this method. Acknowledgement The authors are thankful to the Amity University, Noida.

Table 12: Obtained Results

0000	**0010**	**0001**	**0011**	**1010**	**1011**	**1001**	**1000**
00110011	00110111	00110001	00111010	01110111	01111010	01110001	01110000
00111100	00111000	00111110	00110101	01111000	01110101	01111110	01111111
00110000	00111011	00111101	00110110	01111011	01110110	01111101	01110011
00111111	00110100	00110010	00111001	01110100	01111001	01110010	01111100
11001100	11000111	11000001	11001010	10001000	10001010	10000001	10000000
11000000	11001000	11001110	11000101	10001011	10000101	10001110	10001111
11001111	11001011	11001101	11000110	10000100	10000110	10001101	10000011
11000011	11000100	11000010	11001001	10000111	10001001	10000010	10001100
00000000	00000111	00000001	00001010	10111011	10110110	10111101	10110000
00000011	00001011	00001110	00000101	10110100	10111001	10110010	10111111
00001100	00000100	00001101	00000110	10110111	10111010	10110001	10110011
11111111	11110111	00000010	00001001	10111000	10110101	10111110	10111100
11110011	11111000	11110001	11111010	01000100	01000110	01001101	01000000
11111100	11111011	1111110	11110101	01000111	01001001	01000010	01001111
11110000	11110100	11111101	11110110	01001000	01001010	01000001	01000011
00001111	00001000	11110010	11111001	01001011	01000101	01001110	01001100
16	16	16	16	16	16	16	16

Table 13: Obtained Results

0101	**0110**	**0100**	**0111**	**1100**	**1111**	**1101**	**1110**
00010001	00011011	00010000	00011010	10100000	10101010	10101101	10101011
00011110	00010100	00011111	00010101	10101111	10100101	10100010	10100100
00011101	00010111	00010011	00010110	10100011	10100110	10100001	10100111
00010010	00011000	00011100	00011001	10101100	10101001	10101110	10101000
11101110	11101011	11100000	11101010	01010000	01010101	01011101	01011011
11101101	11100100	11101111	11100101	01011111	01010110	01010010	01010100
11100010	11100111	11100011	11100110	01010011	01011001	01010001	01010111
11100001	11101000	11101100	11101001	01011100	01011010	01011110	01011000
11011101	11010111	11010000	11011010	01100000	01100110	01101101	01100111
11010010	11011000	11011111	11010101	01101111	01101001	01100010	01101000
11010001	11011011	11010011	11010101	01100011	01101010	01100001	01101011
11011110	11010100	11011100	11011001	01101100	01100101	01101110	01100100
00100010	00100111	00100000	00101010	10010000	10011001	10011101	10010111
00100001	00101000	00101111	00100101	10011111	10011010	10010010	10011000
00101110	00101011	00100011	00100110	10010011	10010101	10010001	10011011
00101101	00100100	00101100	00101001	10011100	10010110	10011110	10010100
16	16	16	16	16	16	16	16

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A Study on V2G Technology Incorporation with the Smart Grid Station

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Abstract- *For electrical power industry, Smart Grid (SG) is one of the hot topics in national news and professional conferences from last few years. Its success is depending on the customer need, which is measured in terms of reliability. But in present SG systems, there is always an energy scheduling problem for source and the demand side, as electrical energy demand is growing rapidly. This gives an alarming situation not only for providing sustainable energy but also preservation of environment worldwide. Therefore, in this paper, the vision for futureSG is further articulated by Vehicle-to-Grid (V2G) implementation, so that monitoring and controlling of that electrical power will be possible. Also, the Electric Vehicle (EV) has become integral part of the grid operation. This offers an opportunity to utilize EV's stored energy, when they are in idle (parking) condition means if demandneed is low and sending power back to the grid if demand need is high. This way, flaw less and error less continuous supply is imaginable for the consumers. To get the maximum benefit of this V2G technology, it is enforced to merge the complementary strengths of the EV's and needs of the power grid. This paper will also shed some light on economic impact, advantages and scope of V2G technology.*

Keywords: Smart Grid (SG), Electric Vehicle (EV), Vehicle-to-Grid (V2G), Renewable Energy Sources (RES), Energy Management System (EMS), IoT (Internet of Things).

I. INTRODUCTION

In present times, **Electricity** is considered as the heart of the modern technology and become so vital now and also the whole world is depending on it [1-2].On the other side, electrical energy demand is increasing rapidly so it's not only become the challenge for its production but also for its distribution. This rising demand introduces some complexities in power grids by the amplified need of reliability, security, efficiency and environmentalconcerns [3]. The transport sector is the largest user of oil and also the second largest source of CO2 emissions, therefore the utilities offer the discountedelectricity prices to encourage the grid-friendly charging. As per a recent report, Niti Aayog supportsthe Electric Vehicle (EV) and discourages the privately-owned petrol and diesel-fuel vehicles, therefore this EV market is quickly growing these days [4].

a. Overview on Smart Grid Stations

"Smart" means smart devices and Smart Grid (SG) concept is first implemented in 1997. SG is nothing but the innovation in the electric grid system. Conventional Grids were just to transmit and distribute the power and also lacking in monitoring and real time control, which creates an interesting opportunity for SG stations to act as a real-time solution. For electricity, if considering from generation to consumption point then SG station is defined as an electrical system which uses information, any communication technology and computational intelligence in a combined way across generation, transmission, substations, distribution and consumption to attain a system, which is clean and clear, safe and secure, effective and reliable andsupportable [5].

Fig. 1 Working concept of Smart-Grid Station

In America, SG station goal is to address the aging of distribution network, improve service levels, and enhance user interaction. Similarly, in Europe focusis to promote Renewable Energy Sources (RES), so that power industry meets the environmentally approachable requirements [6-7].

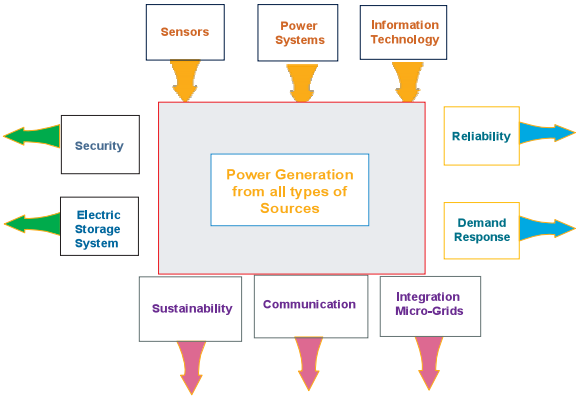

Fig. 2 Smart Grid Architecture

Observation says, SG station even take the decisions according to the situation to maximize the throughput of the system and reduce the energy consumption. Its hugeness and dependency increase by its stakeholders as shown in Fig. 1.

It is basically convergence of industry sectors like electrical power, telecommunication infrastructure and information technology (Smart meters and Sensors) [8]. In this, monitoring and controlling are the crucial roles to make it self- healing, self-organizing and self-configuring. It provides its shareholder a chance to maximize the efficiency, reliability, economic performance and security of their electrical network. An overview of its architecture is shown in Fig. 2.

a. Brief Idea of Vehicle-to-Grid (V2G) Technology

The V2G concept was first introduced by Willet Compton of the Delaware University. The Indian Government had announced the National Electric Mobility Mission Plan 2020 (NEMMP) in 2012, along with Faster Adoption and Manufacturing of EV's (including Hybrid EV's) in India (FAME) guidelines in 2015 to provide incentives to EV's. Also, Norway has the world's highest share of Plug-in EV's per capita. All these things highlighted that by 2030, EV's may take up to 86% of the new light-vehicle sales, as they are promoting night time charging in a very fine way.

The EV basically has three major components and they are *Energy Storage Unit, Control Unit and Propulsion Unit*. **In the first one**, it stores power by ultra-capacitor, battery and hydrogen fuel cell. **The second one,** it modulates the power, decides in what way power must be used and also acts as a converter, which converts power from DC to AC. **The later one**, it has 2 motors, one is for **Power** to accelerate or propel the vehicle to attain a good speed and other is for **Energy** to travel the vehicle for long distances i.e., 200 to 300 miles. The success of any EV highly depends on the type of battery used and its life is measured in terms of cycle stability. It means how many numbers of times a battery can be charged and discharged before being degraded to 80% of its original full charge capacity [9]. Lithium battery offer high energy density if compared to other non- toxic rechargeable batteries. Presently Li -Ion battery is little costly but expected to reduce with increase in cell production volume and improvement in manufacturing technology. These days **Battery Swapping** is also possible, where discharged battery can be directly swapped to a fully charged one, where one can eliminate the waiting period for charging the battery. The EV's battery charging will put an extra burden or load on distribution grid but at the same time EV's positively having the potential to support the grid under various conditions. **Reversible Battery Chargers** are significant, as power flows in both the directions between the EV and the Grid by using V2G technology [10]. According to authors in [11], SG is a cost saving option, so to maintain data safe between generation, consumer and also to maintain integrity to avoid improper function & destruction, security is always needed. In [12], Monitoring, Detection & Classification is needed for the future development topics related to transmission, distribution, commercial, DG & EV to reduce the synchronization problem. So that the computational speed of security algorithms will increase while preserving a high detection accuracy & a low rate of false alarms. In [13], V2G implementation by Genetic Algorithm gives the best solution in terms of energy efficiency & energy consumption. In [14], authors ensure the charge-discharge effect in V2G system, which improves the power quality by using Active Power Filter and also eliminating the harmonics by some Active Measures to get the smooth power. The remainder of the paper is organized as follows: Section II talks about the challenges faced by the SG stations, proposed method i.e. V2G technology is briefly explained in Section III, economic impact of the proposed system is summarized in Section IV then advantages and scope of this V2G technology incorporation is discussed in Section V, finally the conclusions and future work are given in Section VI.

II. Challenges And Limitations In Smart Grid (SG) Station

Good power quality supply at load side, power network to transmit additional energy and cut greenhouse emissions to save the surroundings in spite of having these many advantages in SG station, it is still facing some challenges [15]. Its prime objective is to improve its capacity to use more electricity but at cheaper cost, towards the power developments in the standard-of-living of all the people on this Planet. For the development of our country, our focus should be on the growth of SG by considering its "self-healing" feature, which will protect the grid as a strong grid. The grid is generally designed for the unidirectional power flow, so for returning the power anti-islanding scheme is used which again needs some additional investment. SG station has a lot of challenges in its implementation too like investment, business model, consumer education, and cyber security. Whatever may be the challenges facing by it, it should not be an obstacle to upgrade the existing grid to a best Smart Grid [16].

Some changes must be incorporated into the nature of electricity supply, as the demand is growing rapidly and traditional resources are exhausted. Energy Management System (EMS), IoT, Big Data and SG with EV's are some new technologies in it. If energy demand exceeds the base load power plant capacity, then peak load power plant must be utilized as the power grid itself has not that much enough electrical energy storage [17]. Report says, if the EV's are charged in non-peak hours (6pm-6am) then it would decrease the burden on SG station and its output and efficiency will be improved. And for this, V2G has four

general groups: base load power (station power that is running most of the time), peak shaving (occurs at highest power demand hours), spinning reserves (responds if equipment or power supplier fails), and regulation. The utility pays spinning reserves and regulation sources for just being available and base load and peak shaving are paid per kWh generated [18].

III. INCORPORATION OF V2G TECHNOLOGY WITH SG STATION

Motivation behind this study is to use the battery and chargers in EV's (100 kW or more power capacity) for the grid storage, create a second use when the car is parked which brings a payment to the EV owners. It will balance the power during peak and off-peak hours of the day by introducing RES also in electric markets to provide >> 50% of electricity. Already known to us conventional vehicles are powered by fuels like diesel, petrol and natural gas. Energy conversion efficiency of a fuel is only around 14%– 30% depending on the distance covered, remaining energy is either lost or inefficiencies or used by the power accessories [19].

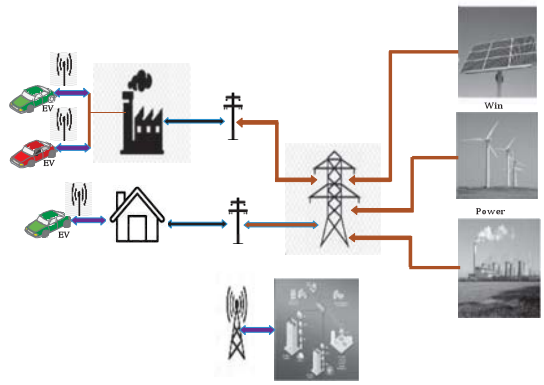

Fig. 3 V2G Technology incorporation with the Smart Grid Station (Solar Energy Management System)

The research on V2G Technology mainly focuses on feasibility analysis, overall structure and the function of each component. The aim is to improve efficiency, reduce cost, volume and weight including the minimization of Total Harmonic Distortions (THD). The most important gradient for V2G to work is the two-way communication between EV and the grid. V2G concept stands on this principle and it works on balance the 'off-peak' and 'peak' demand, only if it is provided at correct time in the correct way. And there is a difference in demands between peak and off- peak times. Three elements are mainly needed for the V2G incorporation: **Power Connection** (energy flow from vehicle to grid), **Logical or Control Connection** (grid operator finds available capacity, request additional services and meter the result) and **Precision Certified Metering** (on board the vehicle)[20].

This technology also needs monitoring to sense the grid status, whether the vehicles should be providing or drawing the electricity at any given time. The idea is to just set up an exchange system between the grid and a vehicle with some energy storage capabilities to help both the involved parties. This is presented all together in pictographic form as shown in Fig.3. In this technology, the vehicle batteries can be fully charged during low-demand hours and flow can be reversed at any time according to the requirements. Therefore, the complete benefit can be taken from the idle vehicles power to provide load-shedding and peak shaving and other tasks. By using some advanced techniques like IoT (Internet of Things), the state of charge of battery in EV can be monitored and controlled easily during the bi- directional power flow between the SG and EV and it will be maintained through EMS [21].

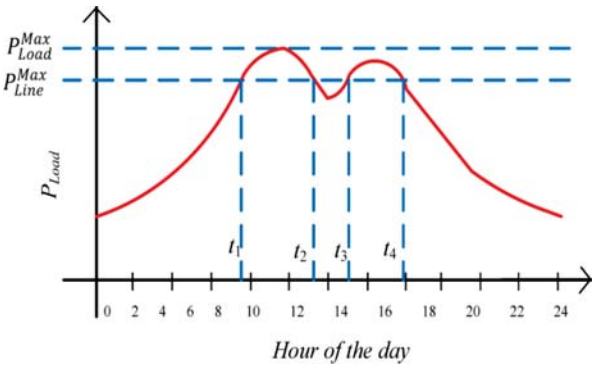

Fig. 4 Load curve and feeder capacity

To calculate the amount of energy needed for peak shaving, an example of commercial load required for peak shaving, is demonstrated in Fig.4.

During peak load period, constraint for "$n-1$" security is the line power flow (P_{Line}) does not exceed the line capacity (P^{Max}),

$$P_{Line} \leq P^{Max} \quad \text{------(1)}$$

EV's are providing power to reduce P_{Line} (assumption), then EV must deliver the difference between maximum power demand (P^{M}) and maximum line power flow (P^{Max}),

$$P_{EV}^{Max} = P_{Load}^{Max} - P_{Line}^{Max} \quad \text{------(2)}$$

where, P^{Max} is maximum required injection power by EV to meet electrical system reliability.

Peak loads may drop below line capacity for a period of time and during this time, EV battery can be recharge from grid until total load exceeds line capacity again. Charging EV during this time, results reduction in number of EV's required. EV energy rating is calculated by integrating desired power overtime as:

$$E_{EV}^{Max} = \int_{t1}^{t2} \{(P_{Load}) - (P_{Line}^{Max})\}dt + \int_{t2}^{t3} \{(P_{Load}) - (P_{Line}^{Max})\}dt + \int_{t3}^{t4} \{(P_{Load}) - (P_{Line}^{Max})\}dt \quad \ldots\ldots(3)$$

E^{Max} is energy that EV must deliver for peak shaving. The number of EV's needed to supply the power needed to reach the top of a particular condition must satisfy the following inequality,

$$E^{Max} < n_1 E_{EV} \quad \text{------(4)}$$

where, n_1 is number of vehicles to provide needed energy during peak shaving and also these vehicles should satisfy the following equation.

$$P^{Max} < n_2 P_{EV} \quad \text{------(5)}$$

where, n_2 is number of vehicles to provide peak power during peak shaving. Finally, the minimum required vehicles (n) can be found as follows:

$$n = Max\,(n1, n2) \quad \text{------(6)}$$

From the above equation (6) it is concluded that by adding minimum number of EV's to the grid, peak load demand can be reduced during peak load hoursand it also reduces the burden on the distribution system.

IV. Economic Impact of V2G Technology

Any new product or if there is some development then it has a factor called Economic Impact Analysis (EIA), which examines the effect of the new thing oneconomy in an area, which may range from a specificarea to the global world. The latest report talks about the requirement of EV's and also the importance of its charging and discharging points all over the globe. The Government is employing "polluter pays principle" in the car tax system, which says high taxes for high emission cars and lower taxes for lowand zero emission cars and it impacts the economic revenue. **Social Impact** says, energy bills will be reduced for citizens and the public authorities therefore, quality of life will be improved by creatinglocal jobs. Also, there is an improvement in air quality. According to **Technical Impact on the Power Grid**, EV integration into distribution grid tells there is no substantial impact on the grid voltages in residential, commercial and mixed feeder. Conventional thinking advises that all Plug-in Electric Vehicles (PEV) would plug in at night or early in the morning hours for the next day driving, but this outlook is limited now, and also misses a factthat vehicles are parked on an average 75% of the time. From this logic, if every car is pluggable then power available is much larger than the current generation capacity by the proposed system and it also helps the Utility Companies to meet the peak demand without the necessity of constructing expensive new power plants. In such power flows, the major stakeholders are: vehicle owners and manufacturers, firms to provide power and the society as a whole. **The Vehicle Owner-** must be waged for the firm touse the vehicle to offer grid services and must be confident that vehicle will be definitely available for the personal use if needed. **The Vehicle Manufacturer-** must be able to chargeV2G capability so that customers will be ready to pay. **The Firm-** must originate enough profit from the vehicles to compensate that additional cost for monitoring and controlling the vehicle-grid interactions, paying owners, and system administration. This way, the proposed method will be the intelligentway for the bulk storage and also economically attractive for the vehicle owners [22]. For Ex. (bi-directional flow/two-way electricity flow between vehicle and grid)- A customer can take his car, plug it into the grid, send power back to the electrical company during peak demand (at high price) and charge his car during off-peak demand (at low price) thus making his own profit from his car only, exactlylike the stock market buy low sell high. Fig. 5. shows the EV can be charged or discharged According to theneed so that it will be benefitted for both

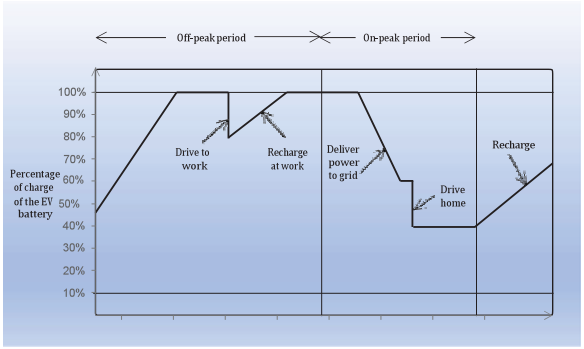

Fig. 5 EV Strategy during off-peak and on-peak periods

the user and power system and it becomes a routine, which wouldincrease efficiency and reliability.

V. V2G System Advantages and Scope

V2G is a new emerging technology which balances the power on generation and consumption side by receiving the power in off-peak hours and sending the same power back to the system in peak hours, where charging stations will behave as grid connecting points [23]. This system is giving benefits to both power grid operators and the vehicleowners along with the clean and clear environment as the emissions are reduced by EV's, which will enhance the efficiency and reliability of overall system. This way, reliance on foreign oil supplies will be reduced by promoting the Energy Security (ES), which favors the growth of EV's. Also, EV batteries that have already reached to the end of theirlife could be given a second chance to reuse them. Finally, it reduces the total distribution losses and voltage drops and protective relay tripping will also be avoided. Electric school bus is

best example for V2G application, as it is having large battery capacity and long parking period too.These days most of the segments are concentrating on V2G technology as it improves the mobility of consumption. The requirements, costs, and benefits for this technology must be balanced, so that it increases the overall productivity. In this, EV's can power small houses or offices by Uninterrupted Power Supply (UPS) as they are having great capacity. Now, it becomes fairly easy to shift from the conventional to non-conventional sources of energy from the stability point of view. Economic analysis says that, now it becomes easier to establishgood relationships between the users and the grid as it is contributing back to the grid.

VI. CONCLUSION

SG station is offering an opportunity to improve the quality and reliability of the power system and it is having the potential to meet the future power demand, which will support the V2G technology. It is really surprizing that how this technology brings positive change in reliability factor for the system. Its features meet both consumer and the utility requirements, where the environment is also a major concern. It is a more constant approach, in which high efficiency and low cost are the important developments. This paper describes the study of V2G technology with SG station in brief way, with which this can be implemented in India. By this study it is concluded that this technology can bring visible benefits from relevant to economical aspect, but still in research a lot of basic work to be explored.

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A Review: Conventional Converter V/S Matrix Converter

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Abstract- *In this paper a review and comparison between conventional converter i.e. DC-Link converter and matrix converter is done. This paper presents the different topologies, pros and cons and industrial applications of both the conventional converter and matrix converter.*
Keywords: Conventional converter, Matrix Converter, pros, cons, applications.

I. INTRODUCTION

The trends in power generation are changing from conventional to modern technologies [1-2]. The basics of conventional converter and matrix converter will be discussed in this section. Conventional converters or AC-AC converters allows control of power, frequency, and phase of the waveform. The two main categories of AC/AC converters are as follows;

(a) Allows change of frequency in waveform, known as frequency converters.
(b) Do not allow change of frequency in waveform, known as AC voltage controllers.

The frequency converters are further classified as: cyclo-converters, matrix converter, DC-link capacitor (AC/DC/AC converter) [3-7].

Matrix converters: basically, matrix converters are developed from recent device advances, newer forms of cyclo-converters. A matrix converter consists of nine bi-directional switches connecting the three input phases to the three output phases. Any time any input phase is connected to any output phase without connecting two switches fort the same phase. Matrix converters are furthers classified as: direct and indirect matrix converters [8-11].

II. DIFFERENT TOPOLOGIES FOR CONVENTIONAL CONVERTERS

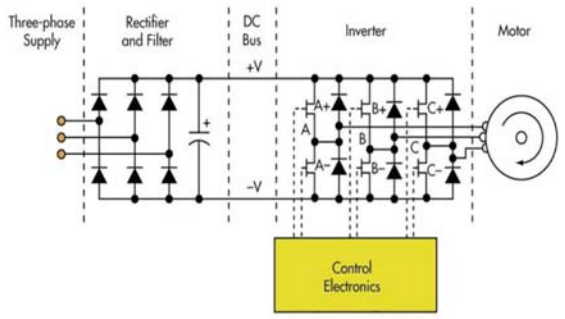

Fig. 1 Frequency converter

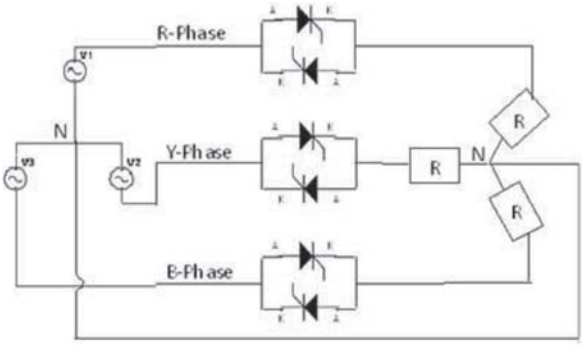

Fig. 2 AC voltage controller

III. DIFFERENT TOPOLOGIES FOR MATRIX CONVERTERS

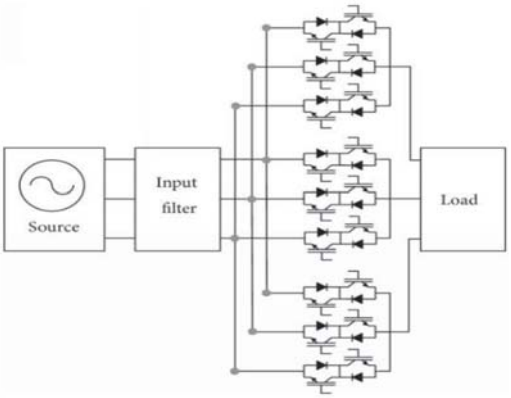

Fig. 3 Direct Matrix Converter

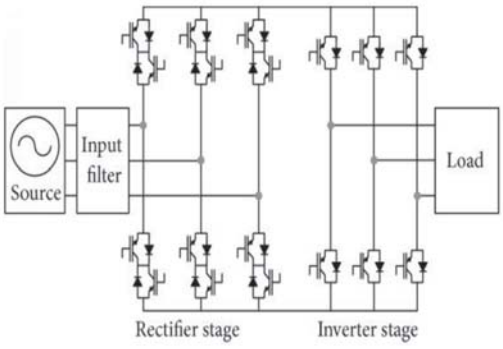

Fig. 4 Indirect Matrix converter

IV. PROS AND CONS

(a) Conventional converter

(i) PROS:

- High efficiency. Since devices losses are reduced, they have high efficiency.
- Flexibility in control.

- Compact size.
- Less maintenance.
- No extra commutation circuit, components requires as they use line commutation.

(ii) CONS:

- The major disadvantages in conventional converter are the load current is not sinusoidal. so armonics are introduced in load voltage and supply current waveforms. It will be more at reduced output levels.

(b) Matrix converter

(i) PROS:

- Matrix converters provide sinusoidal input and output waveforms.
- Higher order harmonics are minimum and no sub harmorics.
- Bidirectional flow capability.
- Fully controlled input power factor.
- Energy storage requirements are minimum.
- Less bulky.

(ii) CONS:

- For sinusoidal input output wave forms, the maximum transfer ratio limited to 87%.
- More number of semiconductor devices require compared to conventional converter.
- Matrix converters are sensitive to the disturbances of the input voltage system.

V. APPLICATIONS

(a) Conventional converter

(i) In power conversion from one distribution standard to another frequency converters are used.
(ii) Frequency converters are in speed and torque control of AC motors.
(iii) Frequency converters are used to control the speed of pumps and fans.
(iv) Power savings and significant energy are achieved in many applications.
(v) Light dimming circuits for streets lights.
(vi) Industrial and domestic heating.
(vii) Induction heating.
(viii) Transformers tap changing.
(ix) AC magnets controls.

(b) Matrix Converter

(i) Phase conversion from m to n.
(ii) Matrix converters are enriched with capability of regeneration in all converter motor drive.
(iii) Matrix converters are used in grid interface for non-conventional energy sources.
(iv) Variable frequency, variable voltage power supplies.

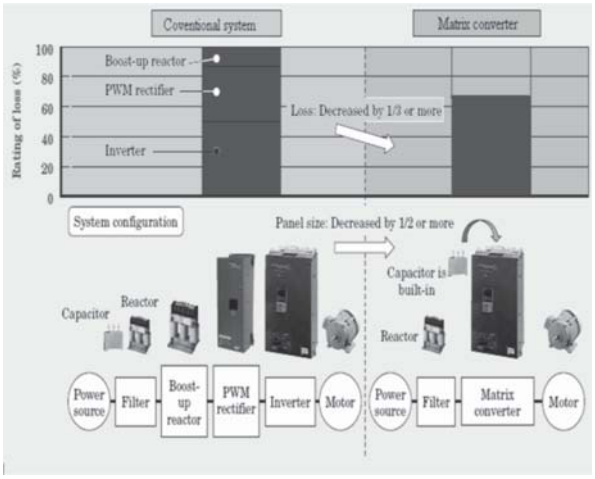

Fig. 5 Conventional System vs Matrix Converters

VI. CONCLUSION

In this paper matrix converter and conventional converter are discussed with their different topologies, pros, cons and applications. After comparing conventional converter with matrix converter, we find that the matrix convener gives better performance matrix converters have netter scope in future.

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Experimental Methodology of Advanced Green House Solar Dryer by Evaluating the Temperature Distribution and Mass Transfer

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Abstract- *The geothermal energy has finite use; biomass and other derivatives (wood and charcoal) are highly efficient in comparison with other energy sources still with dwindling sources of biomass there is need to find alternatives. On top of this there is continuously pollution growth, resources depletion and climate change due to continuous use of conventional fuels. The earth and its atmosphere absorb 3.8×10^{24} J/yr of incoming solar energy. In the solution of energy needs, solar inform of renewable energy source can play a very important role. Cost effectiveness of many renewable sources including solar has been improved there through research and technological developments. It is expected that about middle of this century half of the world's energy needs is likely to be met by the renewable energy and mainly solar energy.*

Keywords- Solar Thermal Conversion, Green House Dryer, Solar Radiation, Forced Convection.

I. INTRODUCTION

The solar energy can be utilized in two ways, directly and indirectly. Direct utilization of solar energy includes thermal and photovoltaic conversion. Indirect utilization includes the use of wind, biomass, wave energy, temperature difference in the ocean and marine currents. In solar thermal conversion system, the energy is firstly collected by using solar pond, a flat plate collector, heliostats (turbine mirrors) or focusing collector. Solar thermal power cycle is classified in three cycles as low, medium and high temperature cycles depending on temp range. The solar energy is directly converted into heat energy by solar collectors. In photovoltaic conversion in solar cells the solar energy. In the field of agriculture solar dryers are most viable method of preserving food product. A cost-effective advanced greenhouse solar dryer has been constructed in this research work and temperature [1-3].

Drying is one of the most efficient methods used to preserve food products for longer periods. A solar dryer is an enclosed unit, to keep the food safe from damage, birds, insects, and unexpected rainfall. The food is dried using solar thermal energy in a cleaner and healthier way. The dryer that has been reconstructed is a mixed mode solar cabinet dryer wherein the blended motion of solar radiation incident on the fabric to be dried and the air preheated in the sun collector offer the warmth required for the drying operations. Here the atmospheric air enters via inlet portion of the sun collector at the lowest give up and the moisten air get exhaust through the outlet element. The goal of the dryer is mainly for the welfare of the marginalized and poor farmers those who can't afford hi-tech facilities and equipment's to preserve their agricultural products and to eliminate the unwanted and unpredictable food spoilage due to lack of facilities in the region [4-7].

II. SOLAR DRYING SYSTEM

(a) Working Principle- The main principle of this low-cost solar cabinet dryer is based on greenhouse effect where the solar heat is trapped inside the drying chamber and thus increases the temperature level. It is a mixed-mode solar cabinet dryer. Here both direct and the indirect solar energy collected in the chamber heats up the food products. Collected in the solar collector heats up the fresh air entering from atmosphere through air inlet and is passed through the lowest of the drying chamber and it collects the moisture from the meals product and exhausted thru air outlet. It is completely based totally on herbal phenomenon. No mechanical and the electrical energy are carried out. Here sparkling air having atmospheric temperature enters the dryer at the bottom stop of the sun collector and leaves on the top most part of the drying chamber through exhaust air outlet. The essence of keeping solar energy absorbing portion at an inclination of 23^0 is because, most of the research found that at this angle absorption of solar radiation is maximum [3-7].

(b) Solar Drying System- Food drying is a very simple, ancient skill. It is one of the most accessible and hence the most widespread processing technology. Sun drying of fruits and vegetables is still practiced largely unchanged from ancient times. Traditional sun drying takes place by storing the product under direct sunlight. Sun drying is only possible in areas where, in an average year, the weather allows foods to be dried immediately after harvest. The main advantages of sun drying are low capital and operating costs and the fact that little expertise is required. The main disadvantages of this method are as follows: contamination, theft or damage by birds, rats or insects; slow or intermittent drying and no protection from rain or dew that wets the product, Encourages mould growth and may bring about a notably excessive very last moisture content material; low and variable first-rate of merchandise due to over - or underneath-drying; big areas of

land needed for the shallow layers of food; laborious since the crop must be turned, moved if it rains; direct exposure to sunlight reduces the quality (color and vitamin content) of some fruits and vegetables [8-11]. Moreover, since sun drying depends on uncontrolled factors, production of uniform and standard products is not expected. Due to the current trends towards higher cost of fossil fuels and uncertainty regarding future cost and availability, use of solar energy in food processing will probably increase and become more economically feasible in the near future. Solar dryers have some advantages over sun drying when correctly designed. They give faster drying rates by heating the air to 10-30^{0}C above ambient, which causes the air to move faster through the dryer, reduces its humidity and deters insects. The faster drying reduces the risk of spoilage, improves quality of the product and gives a higher throughput, so reducing the drying location this is wanted. However, care is needed whilst drying end result to save you too fast drying, with a view to prevent complete drying and would result in case hardening and subsequent mold boom. Solar dryers additionally protect ingredients form dust, insects, birds and animals. They can be created from domestically available materials at an enormously low capital fee and there are not any fuel costs. Thus, they can be beneficial in areas wherein gas or electricity are highly-priced, land for sun drying is in brief deliver or expensive, sunshine is plentiful but the air humidity is high. Moreover, they may be useful as a means of heating air for artificial dryers to reduce fuel costs solar food drying can be used in most areas but how quickly the food dries is affected by many variables, especially the amount of sunlight and relative humidity. Typical drying times in solar dryers range from 1 to 3 days depending on sun, air movement, humidity and the type of food to be dried [12-15].

III. OBJECTIVES

(a) To reconstruct a modified greenhouse dryer model as per available experimental setup.
(b) To simulate the condition as per available data and predict temperature distribution inside the greenhouse dryer.
(c) To predict relative humidity on different time for moisture removal
(d) To analyze radiation intensity and temperature to determine the moisture content and moisture ratio.
(e) Normal glass is used in modified solar greenhouse dryer for further experiment.

IV. IMPORTANT PARAMETERS

The drying of materials involves migration of water from the interior of the material to its surface, followed by removal of water from the surface, which requires an amount of heat equals to the latent heat of evaporation of water. In most cases, the heat comes from the air, which is heated by the solar air collectors in the case of solar drying. Various important parameters are: -

(a) Determination of Moisture Content - The initial mass (m_i) and the final mass(m_f) of the sample are recorded at an interval of 1 hour till the end of drying using the balance. The moisture content on wet basis (M_{wb}) is given as

$$M_{wb} = \frac{m_i - m_f}{m_i}$$

(b) Determination of Moisture Ratio Moisture ratio is given as

$$MR = \frac{M - M_e}{M_o M_e}$$

where M is the moisture content at any time, M_e is the equilibrium moisture content, and M_o is the initial moisture content of potato flake.

(c) Radiation Formula

$$E_b = \sigma T^4 W/m^2$$

Stefe Boltz Mann's

(d) Relative Humidity

$$Rh = \frac{mv}{mvs}$$

mv = Mass of vapour
mvs = Mass of saturated vapour.

V. EXPERIMENTAL SETUPS

(a) Solar Green House Dryer - Solar drying and natural sun drying experiments are carried out for bitter gourd. Fresh bitter gourd is cut into thin slices, and the initial moisture content is measured by oven-drying method, maintained at a temperature of 105°C for 24 hours by taking 200 g sample. Bitter gourd is then spread uniformly on three trays for solar drying and one tray for natural sun drying. The blower motor is then switched on. The air that is passed through the evacuated tube collector gets heated up and is made to flow into the drying chamber, where bitter gourd is loaded in three trays. During the experiment, ambient temperature, relative humidity and wind velocity, solar insolation, inlet and outlet temperatures of the collector, and temperature of all the trays inside the chamber, temperature of the chimney are recorded at the regular

interval of 30 minutes from 10.00 am to 4.00 pm. During the experiment, all the drying trays are weighed on hourly basis until the product acquires constant weight, that is, equilibrium moisture content.

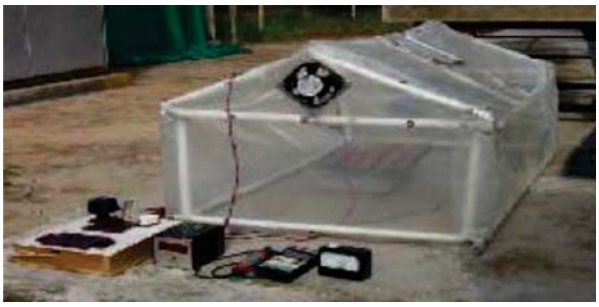

Fig. 1 Experimental setup of solar dryer

Fig. 2 Experimental setup in modified solar greenhouse dryer

(b) Modified Solar Greenhouse Dryer - The proposed greenhouse dryer is of inclined roof even type which is made of rectangular iron pipes and transparent plastic film. The bottom surface of the dryer is packed by black plastic. The roof of the dryer is inclined to latitude of 23°. The drying tray is made of wire mesh with an effective area of 94 × 58 cm². For flow of air inside the dryer two circular holes of 10 cm diameter are provided below the tray position, and for air outlet rectangular hole is provided on top side of opposite wall. To compare the results of this modified greenhouse dryer one simple greenhouse dryer is also made with same dimensions except the roof inclination. All the parameters were set same as for inclined roof greenhouse dryer. Above Figure shows the instruments used and experimental setup respectively. The drying of potato flakes is performed in open sun drying, simple greenhouse dryer and modified greenhouse dryer under natural convection modes. The experiment is performed between 10 AM to 4 PM. The dryer is kept on the ground and far from shade of the trees and buildings. All the experimental observation is taken at the interval of 30 minutes.

VI. Result & Discussion

(a) Experiment Result of Solar Greenhouse Dryer and Modified Greenhouse Dryer Temperature W.R.T. Variation in Time

Table 1: Experimental Results of variation in temperature for the solar greenhouse dryer and modified greenhouse dryer with variation in time.

Time	Solar greenhouse dryer Temperature (^{0}C)	Modified greenhouse dryer Temperature (^{0}C)
10:00 AM	40	47
10:30 AM	42	48
11:00 AM	39	46
11:30 AM	40	52
12:00 PM	47	57
12:30 PM	46	55
1:00 PM	49	56
1:30 PM	48	53
2:00 PM	48	50
2:30 PM	52	57
3:00 PM	54	58
3:30 PM	53	58
4:00 PM	56	59

Table 1 shows the experimental Results of variation in temperature for the solar greenhouse dryer and modified greenhouse dryer with variation in time. We found that Modified greenhouse dryer are increases the temperature as shown in fig. 3.

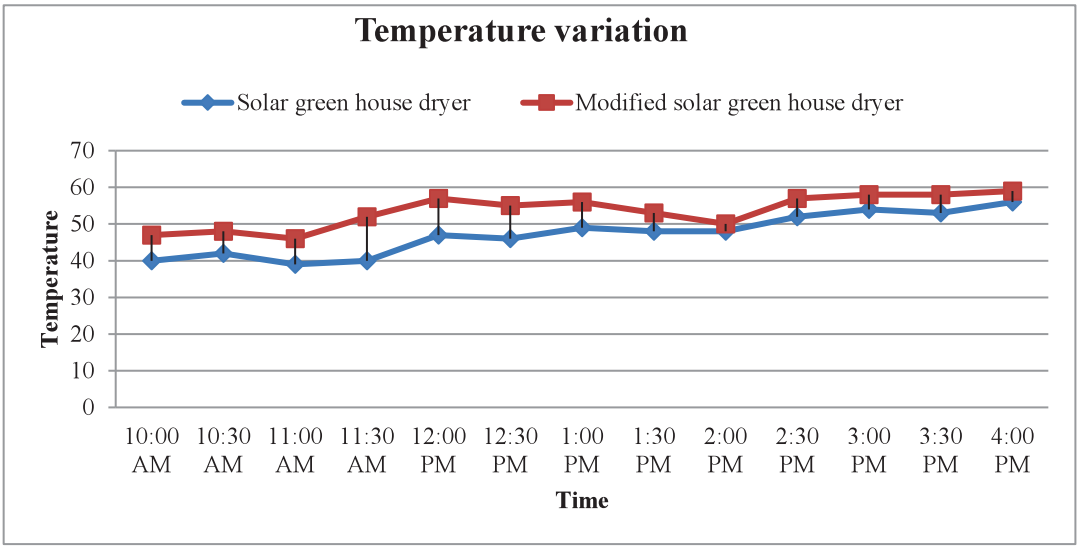

Fig. 3 Experimental Results of variation in temperature for the solar greenhouse dryer and modified greenhouse dryer with variation in time.

(b) Results of Solar Greenhouse Dryer and Modified Greenhouse Dryer Solar Radiation W.R.T. Variation in Time is shown as in Table 2. Experimental solar radiation varied from 964 w/m^{2}to 1141 w/m^2 with maximum value at 2 PM as shown in fig. 4.

Table 2: Experimental Result of variation in radiation for solar greenhouse dryer and modified greenhouse dryer with variation in time

Time	Dryer Solar Radiation (w/m^2)	Modified greenhouse Solar Radiation (w/m^2)	Atmospheric Temperature (^{0}C)	Solar Greenhouse Dryer Fan Velocity Inlet m/s
10:00 AM	964	974	32	3.5
10:30 AM	1100	1050	32	3.5
11:00 AM	1107	1115	33	3.6
11:30 AM	1120	1110	35	3.4
12:00 PM	1140	1148	39	3.2
12:30 PM	1142	1130	36	3.3
1:00 PM	1139	1146	38	3.6
1:30 PM	1138	1148	34	3.2
2:00 PM	1141	1150	35	3.4
2:30 PM	1158	1112	37	3.1
3:00 PM	1094	1102	36	2.7
3:30 PM	1078	1120	33	3.2
4:00 PM	1024	1030	35	3.5

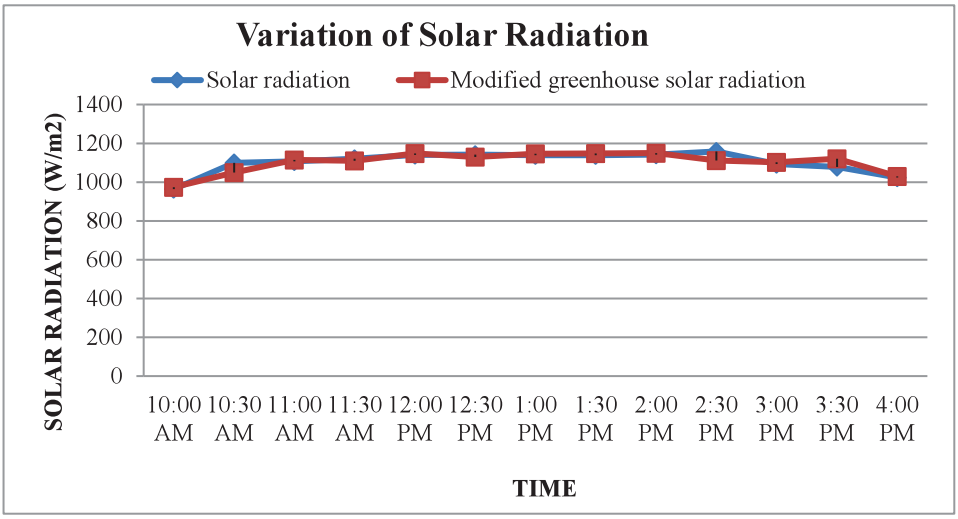

Fig. 4 Experimental Results of solar radiation for the solar greenhouse dryer and modified greenhouse dryer with variation in time.

(c) Results of Solar Greenhouse Dryer and Modified Greenhouse Dryer Relative Humidity W.R.T. Variation in Time

Table 3: Variation of relative humidity

Relative humidity			
Time	**Solar Dryer(^{0}C)**	**Modified greenhouse dryer(^{0}C)**	**Error %**
10:00 AM	30	28	6.6
11:00 AM	24	20	16.66
12:00 PM	23	18	21.73
1:00 PM	20	17	15
2:00 PM	20	18	10
3:00 PM	20	18	10
4:00 PM	15	13	13.33

Table 3 shows the relative humidity values w.r.t time from table, it is determined that relative humidity within the solar greenhouse dryer and modified greenhouse dryer. Modified greenhouse dryer also decreases Relative humidity w.r.t. time. Relative humidity of solar greenhouse dryer under force convection varies between 30% to 15%. If the density of air is low air move upward direction. The same principal is followed here. Due to high temperature in greenhouse dryer and roof inclination the inside humid air moves upper side of inclined roof itself the exhaust fan continuously removes it. The relative humidity inside Modified greenhouse dryer is always less than atmospheric relative humidity.

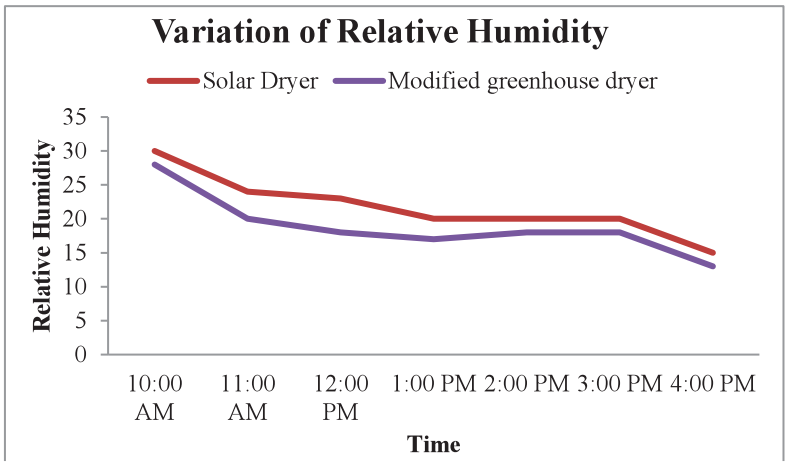

Fig. 5 Variation in relative humidity

(d) Experiment Result of Solar Greenhouse Dryer and Modified Greenhouse Dryer Temperature W.R.T. Variation in Time.

Table 4: Experimental Results of variation in temperature for the solar greenhouse dryer with variation in time.

Time	Solar greenhouse dryer(^{0}C)	Modified greenhouse dryer(^{0}C)	Variation of Results%
10:00 AM	32	36	12.5
11:00 AM	33	38	15.15
12:00 PM	39	43	10.25
1:00 PM	38	42	10.52
2:00 PM	35	40	14.28
3:00 PM	36	39	8.33
4:00 PM	35	37	5.71

Table 4 shows the experimental Results of variation in temperature for the solar greenhouse dryer and modified greenhouse dryer with variation in time. We found that Modified greenhouse dryer are increases the temperature as shown in fig. 6.

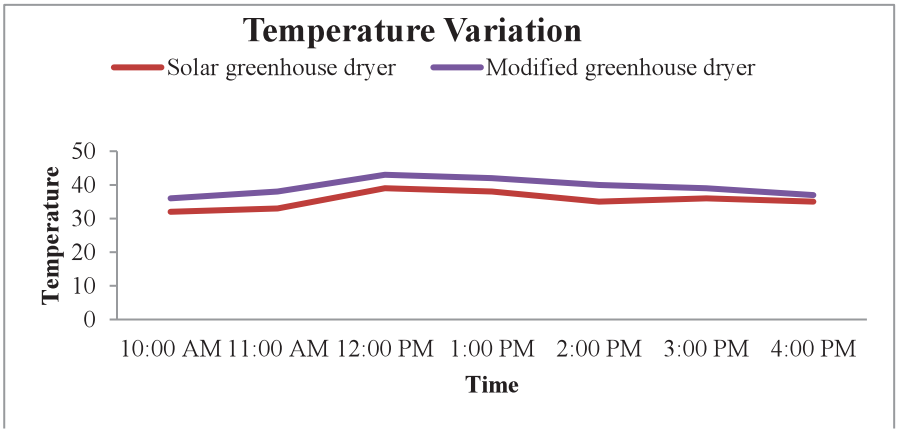

Fig. 6 Variation in temperature for the solar greenhouse dryer with variation in time.

(e) Results of Solar Greenhouse Dryer and Modified Greenhouse Dryer Solar Radiation W.R.T. Variation in Time.

Table 5: Experimental results of variation in radiation for the solar greenhouse dryer and modified greenhouse dryer with variation in time

Time	Solar Dryer Solar Radiation (w/m^2)	Modified greenhouse dryer Solar Radiation (w/m^2)	Atmospheric Temperature (^0C)	Solar Greenhouse Dryer Fan Velocity Inlet m/s
10 :00 A.M	964	974	32	3.5
11:00 A .M	1107	1115	33	3.6
12:00 P.M	1140	1148	39	3.2
1:00 P.M	1139	1146	38	3.6
2:00 P.M	1141	1150	35	3.4
3:00 PM	1094	1102	36	2.7
4:00 P.M	1024	1030	35	3.5

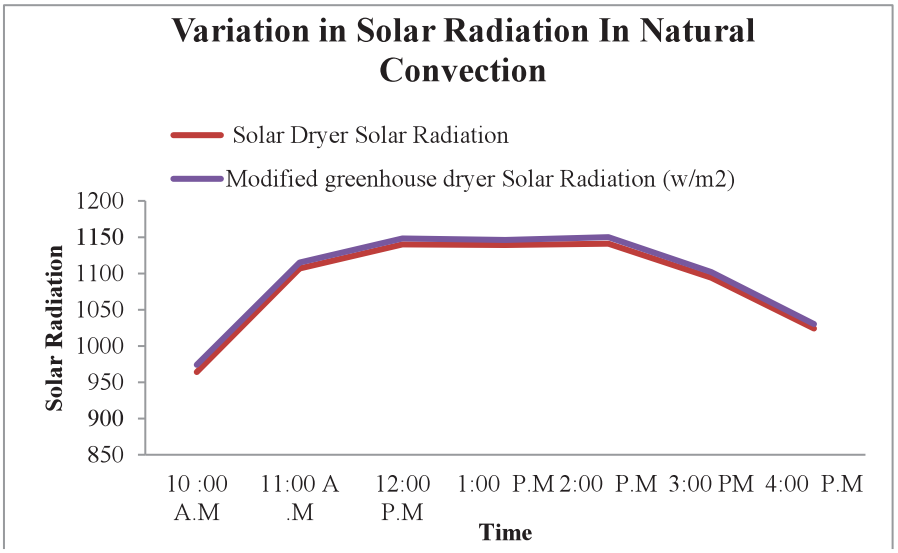

Fig. 7 Variation in experimental results of variation in radiation for the solar greenhouse dryer and Modified greenhouse dryer with variation in time**.**

Figure 7 shows the experimental result of solar greenhouse dryer to determine temperature and Modified greenhouse dryer are slightly above than experimental values.

Comparison of free convection and forced convection

(i) Free convection within a fluid occurs due to density difference within it.

(ii) Force convection occurs due to some external agencies like fan, blower, etc.

(iii) For free convection average value of temperature obtained modified greenhouse dryer varies by about 6.8% to the solar greenhouse dryer for experiment results.

(iv) Variation in solar radiation for frees convection and forced Convection Varies by 0.78% and 0.73% respectively.

VII. CONCLUSION & FUTURE SCOPE

(i) Modified greenhouse dryer experiment results are in good agreement with solar greenhouse dryer experiment results.
(ii) From results, higher value of temperature is found out for Natural convection as compared to forced convection.
(iii) Forced convection shows more convergence than natural convection thus results show improvement of 6.8% average deviation on temperature.
(iv) Effect of solar radiation shows 0.73% average on result thus convergence on solar radiation is achieved.
(v) Thus, experiment of solar greenhouse dryer and modified greenhouse dryer with respect to time shows an optimum result on both natural and free convection at 3 PM.
(vi) Natural convection effect is high thus due to this relative humidity increases and humidity becomes constant thus moisture removal efficiency decreases.

Future Scope

(i) Experimentally analysis can also be done for traditional greenhouse dryer using same Methodology and Boundary condition.
(ii) Inclination angle of greenhouse dryer can be further varied and its effect can be studied on its performance.
(iii) Same methodology can be used to check the performance of indirect type of greenhouse dryers also.
(iv) Tray should be fixed on different angles to increase mass transfer and for better temperature distribution.
(v) Wind velocity of fan could be increased in case of forced convection for a higher amount of moisture removal.

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Analysis of Three-Phase Faults of Power Transformer using Artificial Neural Network

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Abstract- *In this digital era, digital representation of electrical parameters makes the system operation more reliable and sensitive. A digital technique has been used here for analysing the faults. During fault detection, power transformers are prone to various harmonics and inrush current so we have to find a way that can differentiate the unwanted outages of power transformers. Differential protection is one of the most effective and sensitive method of transformer protection. It is based on the fact that during internal fault condition the current entering the electrical equipment is different from that leaving it. Differential relay is most suitable for protection of transformer and is capable of detecting very small magnitude of differential current. Inrush and fault currents are non-stationary and non-periodic signals containing both high frequency oscillations and localized impulses superimposed on the power frequency and its harmonics and transformer transient current signals during faults and inrush conditions deals with short duration. Therefore, discrete wavelet transform that can analyse these harmonic conditions effectively, is most suitable. To analyse the different fault conditions, the digital data obtained after Discrete Wavelet Transform, is fed to Artificial Neural Network. In the present paper we have to study the different operating conditions of the power transformer. Present study is focused on suitably analysing the Inrush condition and Internal faults.*

Keywords: Differential Protection, Power Transformer, Inrush current, Discrete Wavelet Transform and Artificial Neural Network.

I. INTRODUCTION

For continuous and steady supply of electrical energy Power transformer must be protected. For power transformer protection protective relay should operate flawlessly and unpredictably in order to reduce the frequency and duration of undesirable outages. It can be accomplished by no false tripping and high operating speed of circuit breaker accompanying with protective relay. With the progress in the field of digital electronics and signal processing, it is possible to construct fast responsive digital or microprocessor-based relays [1-2].

In case of power transformer one of the challenging problem in detecting the faults is the high magnetizing inrush current. A differential relay that operates on the basis of measurement and evaluation of currents at both sides of the transformer cannot avoid the trip signal during inrush condition, since the transformer inrush current is unlikely rich in second harmonic component and its amplitude may be as high as of internal fault current [3-4].

(a) Traditional Approach

To avoid the needless trip by inrush current, besides harmonic restraint logic, a differential logic is used in the fault detection algorithm in the digital differential protection of power transformer. Traditional methods consider the fact that the ratio of the second harmonic to fundamental component of differential current under inrush condition is more in comparison to that under fault conditions.

But second harmonic restraint principle approach often encounters some problems such as long restrain time because the amplitude of second harmonic and fundamental are computed by discrete Fourier transform (DFT) and the ratio is used to judge whether the current is inrush or internal fault current. But DFT is not precise if the current is contaminated by harmonics that are not integer multiples of the fundamental. DFT only accounts for frequency analysis but does not provide information in the time domain. DFT assumes a periodic signal whereas inrush current and fault currents are not stationary signals. Also, the existence of large quantity of harmonics in the inrush current can cause harm to power factor correction capacitor by exciting resonant overvoltage [5-7].

(b) Modern Approach

Now a day's Numerical differential relays are utilized for protective purpose and is based on advanced digital signal processing techniques and digital devices like microprocessors or microcontroller.

In this work numerical differential relay is devised by simulating it in MATLAB Simulink. This design is applied to protect the power transformer against internal faults and avoid interruption because of inrush currents.

II. TRANSFORMER PROTECTION

Differential protection is one of the most effective and sensitive method of transformer protection. In differential protection an internal fault is recognized by comparing the electrical parameters like currents or voltages at the terminals of the electrical equipment which is to be protected. In this method of protection, we use the fact that

during internal fault the current entering the electrical equipment is different from that leaving it. Differential relay is able to detect even a small magnitude of differential current, hence it is considered as very sensitive and effective method of protection against internal faults.

For differential protection of power transformer, a pair of identical current transformers are coupled at the two sides of the power transformer which is to be protected. The winding ratio of the two current transformers are such that their secondary currents are equal during normal or external fault conditions. Therefore, the differential current that is the vector sum of secondary currents of the two current transformers will be approximately zero or very less. Connection diagram of a basic Differential Relaying is as shown in the figure Fig 1.

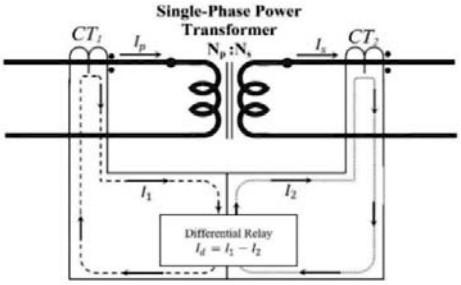


Fig. 1 Basic Connection diagram of a Differential Relaying

Such a common differential relay operating on the basis of measurement and evaluation of currents at both sides of the transformer can't avoid the trip signal during inrush condition, since the transformer inrush current is rich in second harmonic component and its magnitude may be as high as of internal fault current.

(a) Inrush Current

When a transformer is energized, a transient current that might be 10 to 15 times larger than the rated transformer current can flow for several cycles. For power transformers with low winding resistance and high inductance, such inrush current can last for several seconds till the transient will decay away (decay time is proportional to ~ X_L/R).

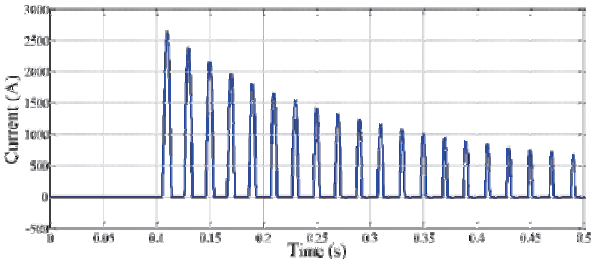


Fig. 2 Inrush current for switching angle 0^{o}

To minimise the magnetic inrush in the transformers that has an air gap in the core, the inductive load has to be synchronously connected near a supply voltage peak in addition to the zero-voltage switching which is desired to minimize sharp edged current transients with resistive loads.

The analysis of inrush current predicts that excessive flux can build up in the transformer core depending on the instantaneous magnitude of the applied voltage and the residual flux at the instant of applying the voltage to the transformer.

(b) Reason of conflict between Inrush and Internal fault

Since transformer switching is a random phenomenon, this makes the magnetizing inrush also random. During energisation large magnitudes of currents flow into the primary winding of a transformer while no currents flow out of the secondary winding. This is similar to the conditions happening during internal faults. Hence there is a chance of incorrect tripping of the circuit breaker. Therefore, it is necessary to discriminate between an internal fault and a magnetizing inrush current.

(c) Numerical Relay

Present power systems are complex networks. Hence for the protection of such a complex network demands the relays to be reliable, secure and short time decision making. Digital relays are programmable and capable to process the information. Whereas the conventional non numerical relays perform only comparison. The digital relays have the capability to perform real time computation [8-10].

III. Discrete Wavelet Transform & Artificial Neural Network

Since inrush and fault currents are non-periodic and non-stationary signals having both high frequency oscillations and localized impulses superimposed on the power frequency and its harmonics, the current is spoiled by harmonics that are not integer multiples of the fundamental waveform. Hence, wavelet transform is an appropriate method for the feature extraction from the waveforms of power transformer under various situations. The extracted features act as the input to the neural networks. Neural network is used to classify and discriminate the various conditions and output of the neural networks are fed to the digital relay to take decision for the breaker operation. This improves discrimination between normal, inrush, over excitation and fault conditions and facilitate faster and more reliable protection for power transformers.

(a) Wavelet transform

It is associated with building a model for a non-stationary signal, with a set of components that are small waves, called wavelets. It is defined as

$$W(a, b) = \int f(t) \frac{1}{\sqrt{2}} \Psi\left(\frac{t-b}{a}\right) dt \int$$

(b) Discrete Wavelet Transform

If the wavelet transform is done in discrete steps, it is called discrete wavelet transform (DWT)". It results in a finite number of wavelet coefficient depending upon the integer number of the discretization step in scale and translation, denoted by m and n respectively.

If a_0 and b_0 is the segmentation step sizes for the scale and translation respectively, then the scaling and translating parameter will be

$$a = a_0^m \quad \text{and} \quad b = nb_0\, a_0^m$$

$$\text{DWT (m, n)} = a_0^m \int f(t)\Psi\left(a_0^m t - nb_0\right)dt$$

(c) Implementation of Discrete Wavelet Transform

Out of a large list of mother wavelets available, the choice of a particular mother wavelet plays an important role in detecting and classifying different types of fault and inrush transients of power transformer. Since the transformer transient study deals with analysing short duration, fast decaying current signals therefore Daubichies's mother wavelet of level 6 is used.

For different transient current signals, the wavelet analysis in different conditions like normal, inrush, internal, external faults and over excitation are performed and observed from SIMULINK.

IV. Artificial Neural Network

A neural network is a massively parallel distributed processor made up of simple processing units, which has a natural tendency for storing experimental knowledge and making it available for use. It resembles the brain in two aspects.

1. Knowledge required by the network from its environment through a learning process.

2. Interneuron connection strengths, known as synaptic weights, are used to store the acquired knowledge.

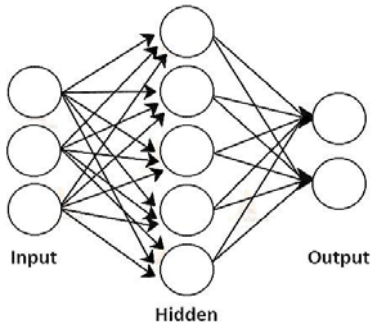


Fig. 3 Basic structure of Multilayer feed-forward ANN.

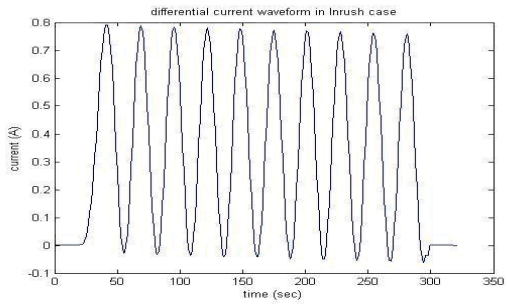
(a) Multilayer Feed-Forward ANN

It is having three layers namely input, output and hidden. Each network layer comprises of processing units known as nodes. Each node in a network layer will deliver its output to all the nodes of the next layer. In the input layer, the nodes receive signals from the outside environment. The output layer of the neural network serves as an interface that sends information from the neural network's internal processing units to the external world.

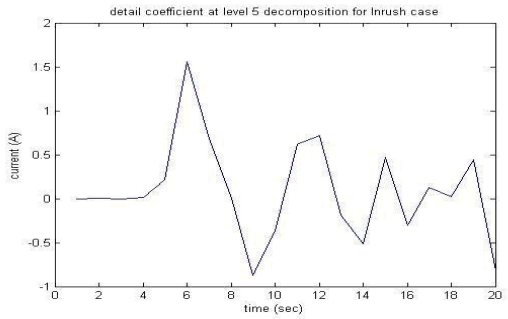
V. Wavelet Analysis Of The Differential Current Signal

(a) Wavelet analysis in Inrush case

Transformer is switched on at 0^O angle of the source voltage.



(a) Original Signal



(b) Detail 5

Fig. 4 Wavelet analysis of the Phase-A differential current in Inrush case.

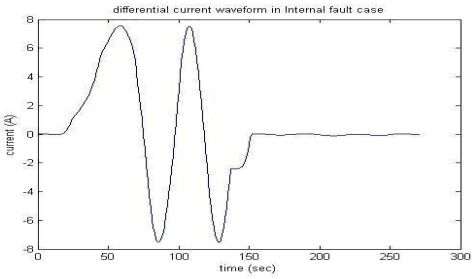
It can be observed in Fig. 4(a) that current get distorted when transformer is switched on at 0^O angle of the source voltage. Here gaps appear along the time of inrush current. Also, magnitude of inrush current changes from nearly zero value to a significant value. This sudden change should produce ripples but these ripples are not visible in time domain representation. These ripples are clearly discriminated in wavelet plots. We know that High frequency components are located better in time domain and low frequency components are located better in frequency domain. Hence, detail coefficients d1, d2 and d3 are realised better in time domain as they contain high frequency components whereas details d4 and d5 are

realised better in frequency domain as they contain low frequency components.

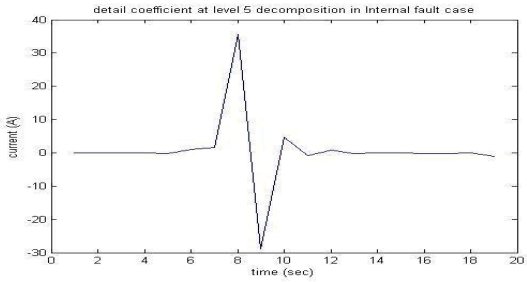
(b) Wavelet analysis in Internal fault case

In internal fault case, wavelet analysis is performed on the differential current signal of power transformer.

Transformer is switched on at 0^{o} angle of the source voltage. It is shown in Fig. 5. The Fig. 5(a) shows the original differential current signal during LG fault in internal fault case while Fig. 4(b) shows decomposed detail coefficient signals at level-5. This analysis is performed for all the three phases. Faults is thrown for the period of two cycles of waveform i.e., for the time 0.10 to 0.14 seconds. Fault resistance is varied over 50 Ω to 100 Ω for getting different samples of data.



(a) Original Signal



(b) Detail 5

Fig. 5 Wavelet analysis of the Phase-A differential current in LG fault case.

From Fig. 5(a), it can be witnessed that there is large frequency distortion in the differential current waveform during internal fault. This distortion is due to the effect of distributed inductance and capacitance of transmission line which results in significant second harmonics in internal fault. This causes difficulty in correct discrimination between internal fault and inrush fault by protection method based on DFT.

Similarly, results are obtained for other internal fault cases like LLG fault, LLLG fault, LL fault, LLL fault cases.

VI. ANN MODELLING AND ITS PERFORMANCE

(a) ANN Model

Feed-forward ANN is utilized for pattern recognition which uses back-propagation algorithm and is capable to identify different fault cases precisely. Sigmoid function is used as activation function whose value lies in the range of 0 to 1.

The statistical data found after wavelet analysis of the differential current signal is first normalized to get a set of data in the range of 0 to 1.

The modelled ANN has 9 input nodes and 9 output nodes to classify 9 types of faults. The number of nodes in the hidden layer is varied to get satisfactory result.

(b) Best suitable architecture of ANN

Number of input nodes = 9
Number of nodes in hidden layer = 15
Number of output nodes = 9
Momentum factor, m = 0.9
Learning Rate, n = 0

VII. SIMULATION

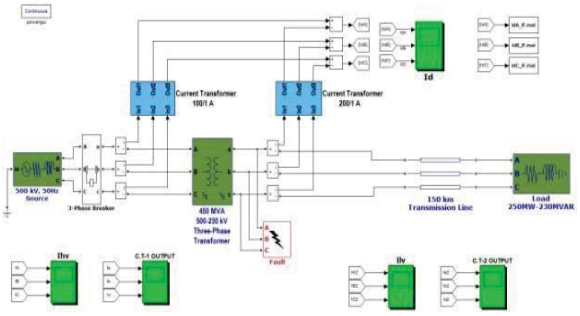


Fig. 6 Simulation Setup

VIII. CONCLUSION

From the study and analysis accomplished in this work, it is observed that DWT is suitable for extracting the transient differential current signal in both the time and frequency domain. It visualized the high frequency detail components (d1, d2 and d3) better in time domain and lower frequency detail components (d4 and d5) better in frequency domain. Also, it is capable to visualize ripples in inrush current which cannot be visualized in time domain. Thus, it is able to discriminate inrush current from internal fault current.

Pattern recognition neural network in combination with DWT technique adequately identified the different fault patterns. Also, the performance of network is found satisfactory i.e., mean square error is within the limit. This numerical relay, based on DWT and ANN, shows very less operating time with desirable accuracy.

(a) ANN verses SVM

Support vector machine is other classifier that analyse data and recognize patterns. Here sample data are

represented as points in space and are mapped such that other sample data can be divided by a clear boundary. Test data are then mapped into same space and predicted to belong to a category based on which side of boundary they fall on.

(b) Performance of DWT in noisy environment

Wavelet transform gives time depended resolution of time-frequency domain. So, it is considered that it might be susceptible to noise. So, its performance analysis needs to be observed in noisy environment.

(c) Application of S transform in combination with ANN for transformer protection

S-transform is a recent technique of signal processing. It is variable window of STFT (Short time Fourier transform) or an extension of wavelet transform. It gives frequency dependent resolution of time-frequency domain, so it is merely susceptible to noise. It may give better result in noisy environment.

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Comparative study of Various Substrates for Oyster Mushroom Cultivation and its Nutrient Analysis

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Abstract- *Edible mushrooms are the fleshy and edible fruit bodies of several species of macro fungi. Mushroom Edibility may be defined by criteria that include absence of poisonous effects on humans and desirable taste and aroma. It is a good source of amino-acids, proteins, vitamins and minerals. It has rich number of fibres and good energy boosters for adolescence. Mushroom cultivation is becoming one of the major income sources for Indian farmers. But most of farmers are not aware of mushroom cultivation process. Mushrooms can be cultivated using agro-based waste as substrate (growing medium). The yield of mushroom depends on substrate used and other mushroom cultivation room temperature, moisture, CO_2, and atmospheric humidity. This paper covers comparative study of impact of substrates on mushroom biological efficiency and its nutrients. Our main objective would be carrying out comparative analysis of impact of various types of substrates on both mushroom yield and its nutrient contents in particular for oyster mushroom. The figure millet and paddy were used as substrates in different proportion. Among the various combinations experimented, 100% Ragi substrate resulted in best yield and also resulted in better protein, carbohydrates and lipids when compared to other combination of substrates.*

Keywords: Oyster Mushroom, substrates, nutrient analysis, biological efficiency, Value added products

I. INTRODUCTION

Mushrooms are umbrella-shaped fruiting body (sporophore) of fungi and as the name suggest it requires moisture for its growth. In Rig-Veda, Ancient India, China mushrooms are ritual food, Greeks used to feed warriors. Due to absence of chlorophyll, it is unable to synthesize its own food and hence is dependent upon organic matter/substrate for food. In world there are about 69,000 varieties of mushroom but only 2000 of them are edible [1]. Mushrooms have high health benefits; it is good for people with diabetes, blood pressure since mushrooms are having low sodium content. Mushrooms have antimicrobial, anti-tumor, anti-viral properties, very little fat, sugar and without starch & cholesterol. Selenium: Mushrooms contain more selenium and all edible mushrooms are good sources of selenuim. Selenuim may also be an anti-cancer substance since it has been proven to reduce the risk of prostate cancer. There are more than 30,000 identified types of mushrooms worldwide; 99% of these are edible and roughly 1% is poisonous. Edible mushrooms are consumed by humans for their nutritional value and medical value. India, China, Taiwan, Japan, Korea and Thailand have the highest global export rates of mushrooms, since Asia's environment is suitable for mushroom cultivation. Mushroom cultivation incurs nominal cost, hence is a good source of income for farmers, in turn contributing to country's economy. The commonly grown mushroom in India are Button mushroom (Agaricusbisprous), Oyster mushroom (Pleurotusostreatus), Milky mushroom (Calocybeindica), Straw mushroom (Volvariellavolvaccea), Cremini Mushroom (Agaricusbisprous), Shiitake Mushroom (Lentinulaedodes) and Portobello Mushroom (Agaricus). Mushroom is commonly grown in the various states as shown in Figure 1. Mushroom industry in India is overwhelmingly focused on white button mushroom, milky mushroom and oyster mushroom [2].

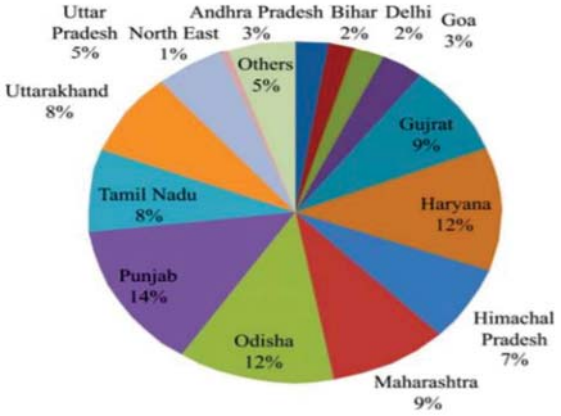

Fig. 1 Mushroom growing in various states

The Pleurotus (Oyster mushroom) species produce several medicinal and pharmacologically interested metabolites, such as antimicrobials, immunostimulants, antioxidants and anti-tumourals. This mushroom is also known as "wood decaying fungus".

Mushroom contains 20-35% protein which is higher than those of vegetables and fruits and is of superior quality. Mushroom cultivation technology is the suitable method for the conversion of agricultural waste. This is the most efficient and economically valuable technology for conversion of high lignocelluloses into high quality protein food. In India, Mushroom growing is highly rewarding because of variable climate where different kinds of mushrooms can be grown in various environmental situation [2-5].

In the cultivation room should be strictly maintained like relative humidity, moisture, air circulation, Temperature is to be maintained according to type of mushroom. In general, relative humidity is 75-95%, Carbon dioxide 600-700 ppm, apt Temperature 25^0C.

Commonly used substrate is: banana leaves, citrus peels, coffee sawdust, corn (cobs and stalks), cotton straw, grasses, gum and pine sawdust, straws of paddy, ragi, maize, jowar, bajra, sugarcane baggase, sorghum or any millet, coffee grounds**,** wood shavings, legume straw and pods, paper waste, water hyacinth, wheat straw and wood logs etc have been successfully used for cultivating oyster mushroom. [6].

This paper is briefed as follows. Section 2 briefs about related work on mushroom cultivation. Section 3 covers the oyster mushroom cultivation process. Experimental work carried using two types of substrates: paddy and finger millet (ragi) straw and its different combination of Rice and paddy to evaluate the effect of different substrates on mushroom yield using biological efficiency and nutrient analysis is briefed in Section 5 followed by conclusion in Section 6.

II. Literature Review

Among the available mushroom grown, oyster mushroom can be easily grown from locally available agricultural waste /products as substrate.

R. Vijayakumar et al.,[1] suggested that growing oyster mushroom in paddy straw, sugarcane trash, banana leaf sheath, and leaf litter and its combination , among that paddy straw and Leaf litter + paddy has shown highest yield 526g and 478.6g, biological efficiency 52.6% & 47.86% respectively and has shown maximum number of proteins and carbohydrates while in Somashekhar et al.[3],Oyster mushroom on different substrates like Ragi straw, coconut husk, Areca nut husk, Fodder Sorghum Straw, Guinea grass straw which is abundantly available in local area when compared to Paddy straw. Ragi straw has shown maximum yield (1.41 kg) and biological efficiency (70.4%) followed by paddy straw (61.6%) and Guinea grass straw (60.0%) significantly compared to other substrates.

Baysal [7] suggested that oyster mushroom cultivation in waste paper supplemented with peat, chicken manure and husk rice (90 + 10; 80 + 20 w/w) in its combination they found that addition of rice husk to waste paper significantly increased spawn running, pin head formation, fruit body formation and mushroom yield, waste paper added to chicken manure and peat has shown in loss due to high C/N ratio.

As mushroom's life span is less of 2-3 days it can converted into value added products like Mushroom Jamoon, preserved as Murabba, Rasam Powder, Pickle, biscuit, Soup powder, Nuggets, Ketch-up, Candy, etc also in turn increasing the income. Mushroom could use as weekly twice food supplements as curry's [8].

Almost no work is reported for studying impact of paddy and ragi and its different combination on both nutrient analysis and biological efficiency of mushroom. In this context, we have carried out work to study the impact of paddy and rice and its different combination on both nutrient analysis and biological efficiency of mushroom. In addition, ragi is commonly grown in Karnataka in addition to paddy, hence are easily available local farmers with no investment on substrates. Farmers are not aware of mushroom value added products, this paper covers various value added products of mushroom, which can be additional source of income.

III. Oyster Mushroom Cultivation Processes

Figure 2 depicts the Oyster Mushroom cultivation processes. Usually, most of the farmers both in India and abroad use polythene bags for cultivating oyster mushroom. The mushroom cultivation room must be hygienic to avoid any microbial and/or fungal attack in mushroom. The substrate is chopped and sterilized followed by partial drying so as retain enough moisture to prepare mushroom bed. The drying test is done by squeezing test. The spawns and substrate material is filled in the polythene bags in layered fashion. Spawning is recommended to be done at lower rates because over spawning can cause rise in temperature and CO_2 concentration within substrate which can be harmful for mycelium. Slightly cooled straw is filled in the plastic bags and spawning is done. By sanitizing hand

with dettol or being sure the hands are free from pathogens then straw was filled in the bags. During spawning great care should be taken to avoid pathogenic contamination. Spawn is spread in every layer of 4-5 cm height and pressed the straw slightly to make bag compact. After filling the bag with spawn and straw, mouth of bag should be tied with thread. Pin holes are made with the help of needle for aeration. These bags are kept for incubation in dark room for 15-17 days depending on the substrate combination, the bags appear white due to growth of mycelium. The bags are kept for additional 3-5 days to ensure mycelium growth. After first 20 days from the day of cultivation, the spawns start growing into mushroom. This is usually seen as white patches inside the polythene cover, in those while patch location, the framers need to manually cut the polythene covers gently with utmost care to provide place for spawns to sprout out. Primordial growth of mushroom is seen one week after cutting of plastics. During this stage diffused light was provided in the room. The right time to judge fruiting body is when it has reached a shape and size. Mushroom fruit body doubles for every single from the day its pin head appears so hence fruit body is achieved soon within 4-6 days. Picking was done by twisting the mushroom gently so that it is pulled out without leaving any stub and also nearby fruiting bodies are not disturbed. During the entire process of mushroom cultivation, the moisture, temperature of mushroom bed and CO_2 in cultivation room must be monitored so as to get better yield. This process involves daily monitoring and dedicated man power.

Fig. 2 Oyster mushroom cultivation process

IV. Materials And Methods

An experiment was conducted using paddy and ragi straw as substrates in different proportions so as to estimates its impact on both nutrient analysis and yield. Oyster Spawn, Polypropylene cover of size 12×16 inches, Paddy and ragi straw, Chemicals: Formalin and cliva plus are used for mushroom cultivation. Oyster spawn was purchased from Krishi vigyan Kendra, Hirehalli, Tumkur, Karnataka. Both paddy and ragi Straw was collected from local farmers. Proportion of substrates (paddy and ragi) used for the experimental work is briefed in Table 1. Total of 10 bags of mushroom was cultivated using one kg spawn and 600g (wet) substrate per bag.

Table 1: Proportion of substrates (Ragi and Paddy) used for the experimental work

S. No	Percentage Proportion for the experiment
1	100% Paddy straw (PS)
2	100% Ragi Straw (RS)
3	75% PS + 25% RS
4	75% RS + 25% PS
5	50 % PS + 50% RS

V. Results And Discussion

Analysis of impact of different combination of ragi and paddy substrate on biological efficiency of oyster mushroom: Biological efficiency (BE) of mushroom is calculated using Eq. (1) and the obtained results are shown in Table 2. Mushroom was cultivated for three flushes F1, F2 and F3. The mushroom cultivated in flush F1 and F2 was not infected with any kind of diseases, but flush F3, almost all the substrates was infected by green mould hence resulted in very poor yield. Table 2 clearly proves that for F1 and F2 flush, substrate with 100% Ragi straw resulted in better yield and biological efficiency when compared to other substrate combination. Compared to second flush, the BE for first flush is high, may be due to the availability of maximum nutrients in substratum. But since the flushF3 was infected by green mould it resulted in reduced yield & BE. The results in Table 2 prove that the substrate definitely has impact on both yield and BE, but in addition one should maintain the hygienic condition, since if not take care, it results in poor yield and BE irrespective of type of substrate used. The impact of different combinations of proportions of Ragi and Paddy straw on BE for three flushes is depicted in Figure 3. BE for F3 illustrates the impact of presence of green mould in reduction of BE as well as impact of substrate nutrients on BE.

Time course for completion of spawn running, days for initiation of pin heads and fruiting body formation and completion of fruit body formation for oyster mushroom is briefed in Table 3. It was observed that for F3 which was infected by green mould, the completion of spawn running, days for initiation of pin heads and fruiting body formation for oyster mushroom was delayed by almost 1 week.

$$\text{Biological efficiency} = \frac{\text{Weight of fresh mushroom harvested}}{\text{Weight of wet substrate in each bag}} \times 100 \quad \text{----------(1)}$$

The biological efficiency was determined against the dry weight of each substrate. The biological efficiency of different substrates ranges between 49.50 % to 108.03 %.

Table 2: Weight, Average yield and biological efficiency of oyster mushroom for different combination of substrates for 3 flushes.

Substrate	Weight of substrate(g)	Weights in batches (g) (yield)			Total yield (g)	Biological efficiency (of 3 flushes)
		Disinfected Mushroom batches		Green mould infected mushroom batch		
		F1-yield	F2-yield	F3-yield		
100 % Paddy Straw [PS]	600	290	210	118.2	618.2	103.03
100% Ragi straw[RS]	600	309.6	230	110	649.6	108.26
75%PS+25%RS	600	137	105	55	297	49.50
50%PS+50%RS	600	262.4	230	55	547.4	91.23
25%PS+75%RS	600	225.2	202	75.7	502.9	83.82

Protein was highest with 11.09 for 100 % Paddy Straw [PS substrate and lowest for 100 % Ragi straw [RS] substate]. Carbohydrates was highest with 56.89 for 100% R substrate and lowest with 14.08 for 75 % PS + 25 % RS Substate. Amino acid was highest with 3.46 for 100 % RS substrate and lowest wih 1.27 for 100 % PS Substate. Lipids was highest with 3 for 100 % RS substrate and lowest with 1.19 for 75 % PS + 25 % RS Substate. The nutrient analysis of oyster mushroom for each substrate was done and is shown in Table 4. According to R. Vijayakumar et al, [1] the steps for nutrient analysis was done and the results are recorded and tabulated.

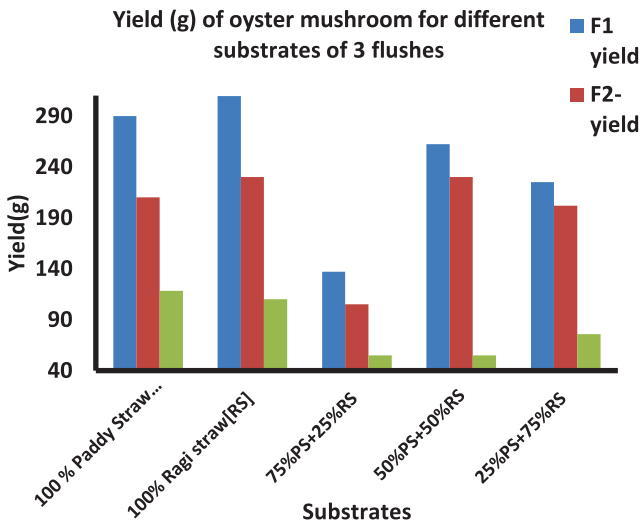

Fig. 3 Comparative Yield (g) of oyster mushroom for different proportion substrate in three flushes.

Table 3: Time course for completion of spawn running, days for initiation of pin heads and fruiting body formation for oyster mushroom of three flushes

Substrate (straw)	Completion of spawn running (In days) for first flush	Days for initiation of pin head formation for first flush	Fruiting bodies formation (Days) first flush	Completion of fruiting body formation in days of last i.e. 3rd flush
100% Paddy straw [PS]	19.26	22.5	27.3	45
100% Ragi straw [RS]	17.15	21.3	26.4	55
75%PS+25%RS	21.35	22.4	28.5	51
50%PS+50%RS	19.07	26.04	33.3	58
25%PS+75%RS	22.34	23.05	29.3	50

Table 4: Compariative study of the nutrient analysis of oyster mushhoom for each substrate

Substrate	Protein (mg/g)	Carbohydrates (mg/g)	Amino (mg/g m)	Lipids (mg/g m)
100 %	11.09	15.866	1.27	1.58
100 %	7.67	56.89	3.46	3.0
50 % PS +	9.86	49.68	3.1	2.99
75 % PS +	10.119	14.08	1.32	1.19
25 % PS +	10.22	60.11	2.38	2.9

VI. Conclusion

A comparative study of impact of two types of substrates namely Ragi and Paddy straw and their combination was done for oyster mushroom cultivation. Best mushroom yield was obtained using Ragi as substrate with biological efficiency of 108.26 and lowest for (75 % paddy PS + 25 % RS) combination substrate. It was observed that the one of batch which got infected by green mould resulted in poor yield, hence we can conclude that it's not only substrate that has impact on yield but one needs to maintain hygienic conditions during mushroom cultivation process. In addition, a comparative study of impact of two types of substrates on mushroom nutrients was carried out. Mushroom grown with ragi substrate has protein of 7.67 mg/g, carbohydrates of 56.89 mg/g, amino acid 3.46 mg/g and lipids of 3.0 mg/g. Ragi straw which is abundantly available in Tumakuru district of Karnataka, hence could be a potential agricultural substrate in this location for mushroom cultivation at low

cost. Since the mushroom cultivation process is easy and requires nominal investment, it can be taken as addition source of income for rural women.

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Phytoremediation Technology useful in Maintaining Green Vegetation.

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Abstract- *Land plants are destroyed by various heavy metals, pollutants, sewage water, explosives, industrial wastes. When plants are planted on this land, they show eradication of various heavy metals and pollutants. It can be minimized by Phytoremediation technology. Phytoremediation technology explained as the use of green plants to clean air, water and soil. Phytoremediation technology useful in maintaining vegetation green. Lead and chromium are remediated by Phytoremediation technology. It's process and mechanism, consists Eicchornea crassipes and Tomato plant.*

Keywords- Phytoremediation, Heavy Metals, Tomato, Eicchornea, Mechanism.

I. Introduction

Phytoremediation is cost effective, solar driven, eco-friendly technology. It is used for green plants to remediate pollutants and clean air, water and environment. It Consists of the processes Phytoextraction-Phytoaccumulation, in which, the soil absorbs the water and air pollutants by precipitation or formation of metal complexes by metal transference takes place with water, thus air pollution is reduced. Phytoremediation Technology consists Phytostabilization - Immobility process, of pollutants by transpiration process. Phytostimulation and Phytofiltration is filtering of the pollutants and leads to degradation by microbes.

II. Aims And Objective

Aim of the present work is to remediation of heavy metals by Phytoremediation technology and Phytoremediator plants i.e. Tomato plant and Eicchornea crassipes. Objective is to remediate heavy metals by these plants and maintain green vegetation.

III. Literature Review

Phytoremediation technology is the use of green plants to clean air, water, soil. Phytoremediation technology useful in maintaining vegetation green [1-3]. Lead and chromium are remediated by Phytoremediation technology by its process and mechanism from Eicchornea crassipes and Tomato plant. Phytoremediation Technology consists of the processes-Phytoextraction i.e., Phytoaccumulation, Phytostabilization -Immobility process [4-6]. Rhizofiltration by roots and by rhizosphere microbes, Phytovolatalization by Transpiration, Phytofiltration, Filtration of pollutants, Phytostimulation, Phytodegradation-By Microbes [7-9]. Tomato and Eicchornea crassipes plant have potential to remediate heavy metals and is maintaining green vegetation.

IV. Methodology

Plants i.e., Tomato and Eicchornea crassipes are grown in pots and treated with Lead (Pb) and Chromium (Cr) and keeping plants for few days. Aerial parts are observed by spectrophotometer (AAS) and analysis is done.

V. Result and Discussion

Heavy metals i.e., lead and chromium are remediated to maximum percentage at different concentration and shows the potential of plants as Phytoremediator plants. Reduction in number of leaf and remediation of heavy metals shows this technology is maintaining green vegetation.

Table 1: Remediation of heavy metals by plants Tomato plant and Eicchornea crassipes plant in percentage.

Plants	Lead	Chromium
Eicchornea crassipes in %	90, with final conc.1ppm of 10 ppm lead	77 with final conc 1.13 mg of 5 mg chromium.
Tomato in %	82.2	

VI. Conclusion

Eicchornea crassipes and Tomato plant by the use of Phytoremediator plants mechanism, maintaining the green vegetation and remediation of heavy metals is taking place.

VII. Future Work

Phytoremediation is cost effective technology and has wide applications. The processes are helpful in cleaning environment. Transgenic plants are helpful in near future. The technology has wide scope.

VIII. Application

Helpful in cleaning soil, air, water, land and remediation of heavy metals, and other contaminants by maintaining green vegetation.

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Growth of Indian Agriculture Export during Covid-19 Pandemic

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Abstract- *India has a well established and ever prospering Agriculture Sector and it occupies a leading position in global trade of agricultural products. There are multiple factors which favour India's Agri-Export trade. The recent and ongoing COVID-19 pandemic had pushed the Global Economy into a state of pre recession and many sectors recorded negative growth in 2020. But the Agriculture sector in India has outperformed its production from the past years and equipped the nation with self sufficiency and buffer stock for export. This Paper studies the Impact of the COVID-19 Pandemic on India's Agriculture Export sector. The study reveals that the Agri- export sector has shown a record growth this year and the highest since 2003-04. It discusses the various factors which have contributed to this development. This paper also suggests the various measures and course of action to be adopted to further diversify the India's global trade of Agricultural Products.*

I. INTRODUCTION

Agriculture in India is the most significant contributor to the Economic Growth and employs close to 60 percent of the Nation's population. Over the years the agriculture sector has established itself as a strong pillar of the economy, which has grown stronger since the Green Revolution in the mid 60s'. Agriculture export has been one of the most potential determinants of the overall merchandise export of the country. In the initial years government controlled the export of most agricultural produce so as to provide sufficient supply of raw materials for the domestic agri based Industries. However, with the advent of the New Economic Policy of 1991, the India's trade policy on Agricultural Items has taken a paradigm shift. The objective was made multidimensional with ensuring food security on one hand and developing a strong export base for the agriculture production on the other hand. It, moving simultaneously, would ultimately enhance the farmer's income and also ensure domestic self-sufficiency [1].

In India, agriculture contributes about sixteen percent (16%) of total GDP and ten percent (10%) of total exports. With more than 60 % of land being arable in India and presence of favorable climatic conditions, regular monsoon over a period of time, and presence of a huge manpower, Agriculture in India has always flourished. Rice, wheat, potato, tomato, onion, mangoes, sugar-cane, beans, cotton, cashew, etc are some of the agriculture Products of India which hold a significant economic value in domestic as well as global mark [2]. India has consistently maintained trade surplus in the agricultural products over the years. Moreover, India's terms with other countries have provided for favorable market for its agriculture products.

When the Entire world was hit by the Covid-19 Pandemic in the early months of 2020 there was an anticipation of another Global Economic Recession because most Industries and Services came to standstill. There is a multi-sectoral impact of the virus as the economic activities of nations have slowed down [3]. To contain the spread of the Virus Indian Government came into prompt action by announcing a nationwide lockdown for confining the people in their homes. The production units were stopped, Exports and Imports were restricted, the retail sector was confined to the supply of essential commodities, and most Services were closed for the time being. The pandemic has affected production and marketing through labour and logistical constraints, while the negative income shock restricted access to markets and increased prices of food commodities affecting the consumption pattern [4].

Amid the COVID-19 crisis, agricultural activities related to production and marketing have been deemed "essential services" and were not restricted in any state. However, the lockdowns shut the operations of retail sellers and restricted their movement, constrained the movement of goods severely, closed processing units that consume agricultural commodities, and—despite their essential service tag—shut down some Mandis and markets. Despite the odd conditions there was a considerable improvement in the food grain production and the COVID- 19 induced movement restrictions worldwide did not affect India's Agri-exports as they did with other commodities [5-6].

II. RESEARCH DESIGN

India is a land of Agriculture and Farmers. Its rich Agriculture provides a wide scope of research for the scholars. The recent and ongoing COVID-19 Pandemic has impacted all sectors of the economy due to which there is a need to study the effect and develop a strategic plan for recovery and a precautionary course of action to deal with such situation in the future. This study focuses on the impact of the pandemic on agriculture exports. The

Secondary data was extensively collected from digital sources including the figures from the official portals of Department of Commerce, Department of Agriculture and Farmers Welfare, Press Information Bureau, and from other Scholarly journals and articles. The results were derived after comprehensive evaluation of the facts and figures from the aforementioned sources.

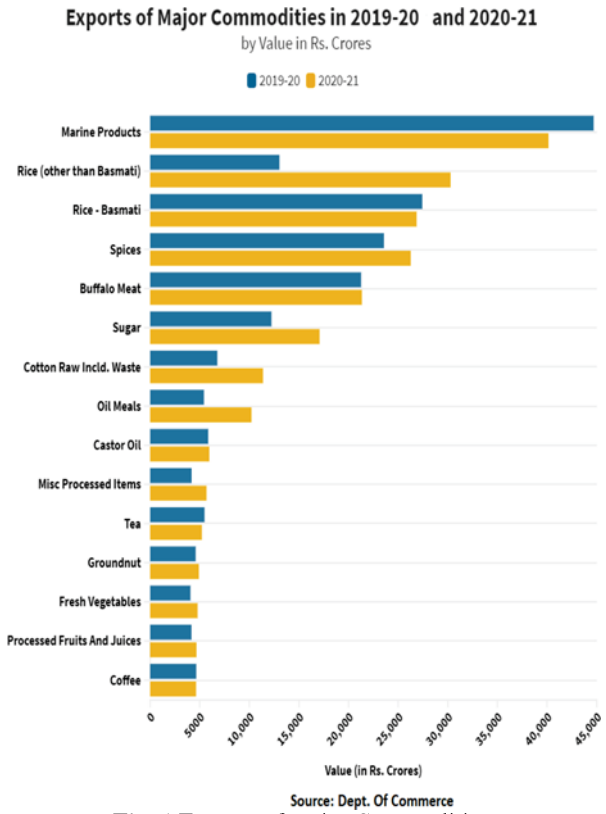

Fig. 1 Exports of major Commodities

As shown in fig.1, India's agriculture export in 2020 has outperformed the figures fromthe previous year. Wheat showed a huge growth in exports, increasing from Rs. 425 Crore to Rs. 3283 Crore, while other cereals recorded a massive Rs. 4542 crores compared to Rs. 1318 in the previous year. Country has witnessed a significant growth of 132% in export of Non-Basmati Rice, which being Rs. 13,030 crores in 2019-20 rose up to 30,277 crores in 2020-21. Apart from the this the other commodities which rocketed the exports chart in the period of April 2020 to February 2021 as compared to the corresponding period during 2019-20 include Spices (Rs. 26257 crore vs Rs 23562 crore; with a growth of 11.44%), Sugar (Rs 17072 crore vs Rs 12226 crore and a growth of 39.64%), Raw cotton (Rs. 11373 crore vs Rs 6771 crore; growth 67.96%.), Fresh Vegetables (Rs. 4780 crore, growth 17.54%) and Processed Vegetables (Rs 2846 crore vs Rs 1994 crore; growth 42.69%) etc [7].

The main drivers of the increase in exports in 2020-21 are wheat (672% increase), vegetable oil (258%), cereals (245%), molasses (141%) and non-Basmati rice (132%). Marine products, Wheat, Non- Basmati Rice, Spices, and Buffalo meat were among the top five commodities to be exported, in terms of value in 2020-21. Together, these five products accounted for almost 54% of agriculture exports the exports of Basmati rice have also slightly dropped by 2% in 2020-21 due to ban on its import by many countries because of extensive use of banned Tricyclazole and Buprofezin in its cultivation.

For over a decade and a half India had market for its agricultural products in the US, China, Afghanistan, Bangladesh, the UAE, Vietnam, Saudi Arabia, Indonesia, Nepal, Iran and Malaysia. However, demand for India's agri products in Europe has declined due to various precautionary trade restrictions by the European Union. But still India has recently gained market access for pomegranate in Australia, Mango and Basmati rice in Argentina, Carrot seeds in Iran, Wheat flour, Basmati rice, Mango, Banana and Soyabean oilcake in Uzbekistan, Tomato, Okra and Onion in Bhutan and Oranges in Serbia. Many Asian countries, which were key players of the agri export, like; Kazakhstan, Myanmar, Russia and Vietnam have imposed cereal trade restrictions like bans, quotas and licensing, which are distorting the global food supply [8].

The massive growth of agriculture export in India can be attributed to multiple factors.

They can be studied under:

(a) Excess Labour involvement and favorable monsoon resulted in increased production in Agriculture sector amidst the Pandemic situation. The public procurement of the agricultural produce has also been record high.

(b) Lesser demand in domestic food and Agriculture based industries due to nationwide lockdown, provided for surplus export stock.

(c) International Trade distortions resulted in the commodity price rice while India offered totrade for a comparatively reasonable price line.

(d) Trade restrictions imposed by several countries had created a highly shaken supply chain for food grains across the globe. It has helped India in emerging as a leading player in global agriculture production market.

(e) On specific demand from countries, National Agricultural Cooperative Marketing Federation of India (NAFED) has facilitated the export of 50,000 MT of wheat to Afghanistan and 40,000 MT wheat to Lebanon under Government-to-Government arrangement.

(f) India captured new markets namely, Timor-Leste, Papua New Guinea, Brazil, Chile, and Puerto Rico.

The market forces of demand and supply have undoubtedly boosted the Indian agri- export sector and the Government acted as a facilitator. The Department of Commerce has made efforts, in collaboration with the Department of Agriculture, for gaining market access for Indian products. Agricultural and Processed Food Products Export Development Authority (APEDA) took actions to boost agriculture exports during the pandemic.

Such efforts include promotion in virtual buyer-seller meets, formation of product specific export promotion forums, hosting product promotion meetings and webinars regularly to understand the challenges and resolving them, and further promotion of GI products. Under the Agriculture and Processed Foods Export Promotion Scheme of APEDA, financial assistance was provided for infrastructure development, Quality Development and Market Promotion.

III. Conclusion

India has, for long, been recognized as an agriculture powerhouse, but hasn't performed much to its potential when it comes to agricultural exports. But the agricultural exports have gained the momentum in fiscal year 2020-21 amidst the COVID-19 lockdown situation This hasagain showed that India can be a leading country in agriculture production and export. Holding a strong position in agriculture Export has a number of positive externalities. Higher agricultural exports would mean better price realization for farmers, increases awareness regarding good agricultural practices and concequently. Greater thrust on quality; an increases awareness of what consumers in other countries demand, which would stimulate value addition and moreoverit will improve employment generation and higher rural income for the country. There have been global concerns on restriction of exports of agricultural commodities by a few global players. India, being trade-surplus on commodities like rice, meat, milk products, tea, honey, horticultural products, etc. may seize the opportunities by exporting such products with a stable agri-exports policy. A few bottlenecks in the agriculture export can be removed which will help the sector to boom. Addressing the logistic bottlenecks will not only make our exports hassle free but also more competitive. Export relaxation on Government's end will encourage the agri-exporters. Some other actions to be addressed are reduction of post-harvest loss, availability of necessary infrastructure like cold storage, proper monitoring of fertilizer and pesticides usage and controlling the use of banned fertilizers, adoption of the latest farm technology, and widening thescope of export finance for agriculture products. State Governments should implement the specific action plans for administering the export of the surplus agricultural production in their region. Efforts for cooperation between exporters and Government are needed for broader market access and expanding of the foreign market. Opening the gates for Private individuals and institutions will also flood this sector with the much required investment. The Government's vision of doubling Farmers' income by 2022 and doubling the farm exports by 2025 seems achievable. The first wave of the pandemic has not affected India's farm exports as much as it affected the other sectors. In fact, the pandemic gave new opportunities and innovations for the farm sector to flourish. The chain of events triggered by the pandemic has had a mixed Impact on the domestic agricultural systems specially in production, marketing and consumption, yet India has emerged as self sufficient and a net exporter of food in the past year.

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Technology based education: A Nostrum during Covid 19 Pandemic

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Abstract- *The objective of this paper is to understand the purpose of technology based education. The paper also discusses the problems associated with technology based learning. An educational institution in India is primarily based only on traditional pedagogy of teaching and learning. They follow the traditional set up of face-to-face lectures in a classroom. But many academic institutions have initiated blended form of learning. If we observe the current status lot of them are still continuing with the old procedures. The sudden outbreak CORONA VIRUS has brought the entire world to a standstill situation. It has been declared as pandemic by the WHO. The education system is also adversely affected by this crisis and is facing lot of challenges. This situation has forced the education platform to opt the online mode of teaching. Earlier the academic institutions that were rigid to change their traditional pattern of teaching are forced to make a shift to the online pattern of teaching. This paper deals with the relevance of technology based education and includes the suggestions on how to tackle the challenge.*

Keywords: Technology, Education, Teaching - Learning, Pedagogy.

I. Introduction

The disastrous infectious Coronavirus caused Covid-19 pandemic. It has deeply affected the entire economy of the world. The pandemic disaster also not left education sector unaffected. The educational institutes have gone for a complete lockdown which also kept continued during the post lockdown phase. The academicians are in a fear as to how the academic session will be continued this pandemic year. Many researchers have expressed their concern that it looks uncertain to get back the person to person teaching any time sooner. The constraint of social distancing is a hindrance and creating a negative impact on the entire teaching fraternity. All the educational institutions are trying to find alternatives to face this unusual circumstance. This makes us realize that there is an immediate requirement concrete planning to face this challenge.

Many arguments have been set forth with electronic learning. The Adoptability, affordability, learning pedagogy and policy are some of the arguments related to online methodology. It presumed that online learning platform is easily reachable and accessible to each and every one. It is considered to be flexible as the learner can plan the course completion time as per their own convenience. The online method of learning is cost friendly as it lowers the transportation cost and other institutional cost also. Moreover, the blended form of learning raises the quality of teaching learning process. The Government is also now realizing the impact and effectiveness of technology based education in this fast changing scenario. This land we to the thought that due to Covid 19 can technology based learning provide us with some remedy so that we all can face this crisis with a new zeal and land up to new horizons even during this pandemic phase.

II. Objective of the Study

(a) To study the necessity of technology based education.
(b) To study the problems associated with technology based education.

III. Review of Literature

Kasinathan et al. [1] examined the potential impact of AI on educational processes and outcomes. It examines key explores concerns with respect to rights-based development that AI policy and programming frameworks should address to support ethical, inclusive and universal education in India.

V. J., & Srikanth R. [2] studied that the ubiquitous technologies have a great potential to enrich students' academic experience. Students are more interested in using interactive learning techniques apart from the traditional learning techniques. The study proposes a modified UTAUT2 (unified theory of acceptance and use of technology) model with nine core independent determinants predicting the tenth dependent variables construct. The study aimed at developing a new model that encompasses the factors affecting the utilization of ubiquitous technology among students in institutes of higher education, particularly in India.

Guma et al. [3] The role of ICT to make teaching-learning effective in higher institutions of learning in Uganda in their study analyzed. This empirical study aimed at finding out the factors influencing use of ICT to make teaching learning effective in higher institutions of learning in Uganda and identifying the innovations that ICT has brought into teaching-learning process, particularly in higher institutions of learning in Uganda. A survey was employed and in order to empirically investigate the study. The findings of this study revealed that teaching staff and administrators had a strong desire to integrate ICT into teaching-learning processes.

Tutkunet al. [4] studied on Internet Access, Use and Sharing Levels among Students during the Teaching-Learning Process.

The purpose of this study was to determine the awareness among students and levels regarding student

access, use, and knowledge sharing during the teaching-learning process. The following results were obtained:

(a) Instances of knowledge access, use and sharing by students during the teaching-learning process rank high.
(b) Female students use the internet in a more functional sense than males.
(c) The levels of students accessing, using, and sharing knowledge during the teaching-learning process differ.
(d) Internet access, use, and knowledge sharing levels vary between academic departments.
(e) Internet access, use and knowledge sharing levels differentiate according to type of education.
(f) The opinions of faculty members and students overlap regarding the level of accessing knowledge via the internet, but differ on the subject of use and knowledge sharing.

IV. Technology Driven Teaching Is Necessity and not an Alternative

People resist change without understanding the need and importance of it and when a situation arises all should adapt to change willingly and unwillingly. This was the situation which occurred to teaching fraternity too. Indian higher education institution has used various pedagogy for innovation, development, and engagement of students. Many faculties have resisted the change when they had been asked to take virtual classes for students [5-7]. The world has been going through a quarantine phase due to the outbreak of COVID 19. Therefore, many places have become a hub and the impact of which can be very well seen in the educational institutes. Amongst all this blended learning and online learning has proved to be remedy during this pandemic. COVID 19 has made the shift from traditional learning to online mode of learning. It has also changed the rigid mindset of the educational institute who were otherwise reluctant to learn the modern form of technology. This transition will surely upgrade the standards of the Indian teaching learning process. The online platform gives us an edge over to connect with large number of students anytime anywhere. It is expected from all the educational institutes to use technology driven classes and also to access it more aptly. There is a sudden boom in the online teaching learning platform and many universities have fully gone for automation. The technology based education has become the need of the hour even in this chaotic situation. Hence quality up gradation has become very important at this stage. Change has become the necessity and this change will only help the educational institutes to grow and develop during this tough time. How the institutes are adopting the new change will become the judgment parameter for the educational institutes. This will also compel them to maintain high degree of quality and also to maintain this quality. The credibility of the educational institutes is on stake. Only time will decide this and also how well they are engraved in adopting the changes. Because at this moment of time a shift from traditional platform to online platform is the only available alternative for us. But yes it's going to be a big challenge for the educational institute as it would not be possible to transform their entire curriculum into technology driven curriculum overnight. As reach and imparting personalized education will be the biggest challenge. Adoptable and innovative solutions can only be the probable help to overcome this crisis situation.

V. Technology Based Learning and its Impactful Practice

There is no doubt that technology driven education was existent since very long but the COVID 19 pandemic has given it new dimensions to grow and flourish. The fact cannot be denied that conceptualizing online teaching and learning has become the need of the hour. There have been many studies done in the past few years and moreover in the past few months during this pandemic period. Students are more interested in using interactive learning techniques apart from the traditional learning techniques. Several research studies for m-learning have been done in the USA, UK concentrating on students undergoing a graduation degree, especially subjects like engineering, arts, maths, science, etc. Hence the need has arisen to conduct a separate research on m-learning in the Indian context [2].

When thought upon as to why online education has become so important in a study done by Moore and Kearsley (2012, page no.8) highlighted the following reasons: -

(a) Providing opportunities for upgrading the skills of the workforce.
(b) Increase the access to learning and training as a matter of equity.
(c) Improving the effectiveness of cost of the educational resources.
(d) Improving the quality of the existing educational structure.
(e) Balancing the inequalities between the age groups.
(f) Enhancing the capacity of the educational institutes.
(g) Expanding the new subject areas.
(h) Problems Associated with Online Teaching and Learning

There are numerous technologies available for online education but at times they create a lot of difficulties for us. These problems are related with modern technology ranging from errors in downloading, installation issue, login problems, audio and video problem, and so on. At times this teaching platform also becomes monotonous for the students. Because of too much flexibility the common excuse that we here form the students is that that they have time to do it. Lack of concentration and attention is also a major hindrance. The teaching learning process is impactful only when there is direct two ways communication which at time is difficult in online teaching. The teaching cannot

reach to its fullest until the students practically practice what they have learnt. Because at times the content through online teaching is completely theoretical which does not let the students mind to create an impactful perception? Average course content is also a matter of concern in many parts of the country and in many universities. Lack of preparedness for the type of online platform being used is another major matter of concern that restricts to impart quality education in many parts of the country.

VI. Conclusion and Suggestions

It is a known fact that lot many issues are associated in online teaching learning process but there also is another fact that its benefits cannot be overlooked especially during this pandemic time. If there is a problem there has to be a solution for it also, we all know this. What is required is the effort to be put in. Examining the key concerns with respect to rights-based development that AI policy and programming frameworks should address to support ethical, inclusive and universal education in India [1]. When teaching through online platform there should always be a backup plan ready so that the teaching learning process is uninterrupted. It is required that methods of online teaching should be more attractive and interactive. The effective integration of this technology into classroom practices poses a challenge to teachers and administrators that teaching staff and administrators had a strong desire to integrate ICT into teaching-learning processes. The innovations that ICT has brought in teaching learning process include: E-learning, e-communication, quick access to information, online student registration, online advertisement, reduced burden of keeping hardcopy, networking with resourceful persons, etc. However, the presence of all these factors increased the chance of excellent integration of ICT in teaching-learning process. Therefore, the training of teaching staff in the pedagogical issues and administrators in administration should be increased if teachers and administrators are to be convinced of the value of using ICT in their teaching-learning process and administration [3]. The technical hindrances can be resolved by way of pretesting the class; prior recording of the lecture to be delivered can be done. As far as possible personalized contact should established with the students. Different social media platforms can be used for communication as the modern age students are very much acquainted to it. Because it is said that communication is the only remedy when things are tough to handle. The learning material provided by the teachers should have a practical approach so the students can do their own self-study and also improve their skills.

For all this the teaching fraternity is also required to spend quality time in exploring the new avenues of technology based teaching. The use of technology in educational context would be effective only if content, pedagogy and technology are aligned carefully. It is strongly recommended for restructuring curriculum of teacher training programs should also be included [8]. It implies that for teachers to use technology in their teaching, they need to be competent in all three domains. The educationalist should also try to research new and modern forms of technology. They are not only required to find this but also are expected to think on how to redefine the educational practices so that ultimately the students can be benefited the most.

Covid 19 has taught us that disasters can hit us anytime and that to a natural disaster like this completely changes all the dimensions of the mankind. But yes, some disasters also give us a strong sense of motivation to bring some innovative changes in one. The same has happened this time. We all have moved a step ahead in adopting technological advancement. The educational sector has used this technological advancement hand to hand. Because of this we are able stay connected with our students through the various online platforms. In order to make the electronic means of learning more specific and effective there is a need to concentrate more on the adoptability and acceptability of technology. The implementation of any kind of technology based education there should be proper research done on its merits and demerits. The need and requirement of all educational institutes differ from each other. Hence, there should be a conceptual adoption of the right technology. Teaching through modern technology sounds very impressive but it has its own demerits. So there is a serious need to assess the pros and cons of technology based learning. Natural calamity like Covid 19 popularly known as Coronavirus has brought the entire nation to a standstill with lot of insecurities and uncertainties in everybody's mind. So, it can be very well assessed that there is an immediate need to accept technology, keeping and maintaining a balance between the uncertainties and certainties. I would like to conclude by saying that this paper is nowhere creating any hike in the online teaching platforms. My intension was only to set forth the drastic change which the entire education fraternity is going through in terms of imparting technology based education. A great job is being done by the teaching fraternity and we should be proud to be a part of this noble profession which is surely a selfless service to mankind.

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Review on Lean Management

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Abstract- *The aim of this study is to review literatures on lean management. Many industries faced different challenges due to the emergence of globalization that led to low productivity which by augmentation evacuated the profitability level of firms intervening in global market. Lean management is amidst the management strategies that are acquiring currency at overturning this diminishing organizational profitability. The approach and method in which lean management is executed in service industry vary from manufacturing. Therefore, one of the easy methods for directing the issue of customers' satisfaction is to apply the method of Lean Management. The objective of this study is to perform a review of literature on the subject matter by exploring the different perspectives of scholars on the issues associated to the adoption of Lean Management Practices in an organization. The outcome of this study and paper has shown that for every industry to achieve competitive advantage and remain profitable it is essential to adopt lean management practices and accordingly, it will enhance customer satisfaction. Furthermore, these approaches will help managers to bring down or remove waste, inventory reduction, diminishing lead time, less rework and financial savings. It is recommended for all the organizations likewise manufacturing or Services industries to adopt lean management practices in the light of tough global competition and growing cost on the local environment.*

Keywords: Lean Management, Continuous improvement, Leadership, Quality, Efficiency, Lean, lean manufacturing, Lean thinking, service sector, Manufacturing and Service Industry, implementation, work flow, process improvement, Just-In-Time (JIT).

I. INTRODUCTION

This concept of lean was developed by the Japanese in 1950s to resolute and normalize the work processes so that the condemnatory problems become distinctly apparent and the manpower prosper critical thinking in order to solve recognized complications in an organization and enhance comprehensive work flow. Lean management practices have been productively put to use in manufacturing industries for the previous two decades in Japan. Lean management practices arisen in Japan and it has manifested effectual in serving industries to enhance their organizational performance. The execution of lean management has been very much fortunate in the manufacturing sector. Due to its high effectiveness, it has been passed on to other sectors in Japan [1].

Womack et al [1] in their book "The machine that changed the world" clearly defined the ideology, which spelled out the evolution of lean manufacturing practices in the automobile industry in Japan. "Lean" manufacturing practices derived predominantly from the Toyota Production System in the 1980s and it has been seen as a sign of coherence and adequate performance. Lean manufacturing process put forward more cost advantage over the mass production approaches that are primarily practiced. The approach of lean management helps organizations in decreasing cost cycle time and removing all waste through continuous improvement.

II. RESEARCH METHODOLOGY

This Literature review explores and investigate the academic literature regarding the utilization of Lean management in manufacturing and non-manufacturing sector. The results were limited to peer reviewed journals, books, eBooks with Years ranging 2011-2021. The article title, subject and key words were reviewed and where required the abstract was appraised for relevance. Review of relevant literature is done.

III. LITERATURE REVIEW

(a) Thiele et al. [2] study in the title of "Using kaizen to improve employee well-being: Results from two organizational intervention studies". The objective of this research was to explore the role of Kaizen- a lean tool for continuous improvement. Data was collected using questionnaire. Cluster randomization was done. Data was analyzed using multi group structural equation modelling. Findings showed that Kaizen helps in increasing the level of awareness and capacity for managing psychological issues which improves job satisfaction and mental health. It was concluded that Kaizen is the effective tool which enables the employees to interact and engage in psychological risk management and integrating employee and organizational objectives and improves their well-being.

(b) Prattana [3] studied in the title of "The Impact of Lean Practices and Organizational Commitment on Operational Performance in Hospitals". The objective of this research was to explore how Lean management practices are adopted by hospitals in Thailand, to investigate how lean practices and organizational commitment affecting operational performance in hospitals. Data was collected using questionnaire survey

from the hospitals implementing lean projects. Data was analyzed using factor analysis, correlation analysis and multiple regression analysis with the help of SPSS. Findings showed that there was a significant relationship between human resource management, patient flow and social capital to operational performance. It was concluded that employees should receive appropriate training to perform multiple tasks which is important for successful implementation of lean project.

(c) Haddach et al. [4] studied in the title of "Role of Lean, Environmental and Social Practices to Increasing Firm's Overall Performance". The objective of this research was to show the impact of lean, environmental and social practices on firm financial, environmental, social, and overall performance. This was an action research and research methodology were based on a qualitative method. Findings showed that combination of these three practices- Lean, environmental, and social practices leads to best overall performance. Performance outcomes and implementation level of LES Practices was influenced by firm size and age. It was concluded that Lean practices has a significantly positive effect on organization overall performance.

(d) Oláh et al. [5] studied in the title of "The Impact of Lean Thinking on Workforce Motivation: A Success Factor at LEGO Manufacturing Ltd." The objective of this research was to present the practical use of Lean approach in the LEGO manufacturing Ltd. Plant, to present the current state of behavioral structures that indicate the motivational level within an organization, to assess the level of motivation of the employees of LEGO Manufacturing Ltd.'s towards the Lean attitude, to find the factors which affect this motivation. Data was collected using questionnaire and interviews. Data was analyzed using descriptive statistics, SPSS, Levene's Test for Equality of Variances, Two-independent T-test for Equality of Means, Spearman's rho. Findings showed that Employees do not experience the benefits of lean thinking in order to improve competitiveness during their work because they do not know the positive factors which can contribute to the existence of lean thinking. It was concluded that Workers are happy to help each other and also happy to ask for help from each other and their superiors.

(e) Ciano et al. [6] studied in the title of "The link between lean and human resource management or organizational behavior: a bibliometric review". The objective of this research was to analyze the relation between Lean and Human resource management or organizational behavior. Data was analyzed using bibliometric analysis, main path analysis and citation network analysis. Findings showed that there is a need of cross-fertilization between the fields. It was concluded that Lean has a strong relation with Organizational Behavior and Human Resource Management.

(f) Bayat et al. [7] studied in the title of "The Impact of Organizational Factors on Implementation Outcomes of Lean Manufacturing". The objective of this research was to examine the correlation between organizational factors, organizational structure, and job design with implementation outcomes of lean manufacturing that impact quality, waste, and delivery. Cross-sectional research design was used. Data was collected using questionnaire. Data was analyzed using pearson correlation, multiple regression analysis, factor analysis, chronbach's alpha reliability with the help of SPSS. Limitation was that the study sought participation of individuals who are in different levels of managerial position and engineers with good experience with lean manufacturing who were willing to spend time to answer 60 questions. Due to busy schedules and time unavailability of this type of individual, the participants sample population was limited to 84 individuals. This study relied on the perception of participants and results are only generalized to this type of occupation. Findings showed that lack of attention to formalization affects companies' ability for continuous improvement due to the lack of specific and commonly understood methods to carry out every important step in every process. It was concluded that all organizational activities affect quality, waste and delivery [8].

(g) Beale et al. [9] studied in the title of "Employee Motivation to Adopt Lean Behaviors: Individual-Level Antecedents". The objective of this research was to explore the impact of various individual-level factors (job-related, personality-related and demographic) on employee willingness to adopt Lean behaviors or Lean methodology. Data was collected using interviews, survey questionnaire, focus groups. Data was analyzed using multiple regression analysis. Findings showed that motivation for lean is directly influenced by employee attitudes, perceived ability and the perceived social pressures to adopt Lean behaviors. Indirect antecedents include self-efficacy, job satisfaction, organizational commitment and organizational level. It will be possible to manage employee motivation for receptiveness to Lean through proper training programs and designed communication. It was concluded that Training could boost employee motivation for lean through increased commitment. Training is a type of reward which increases organizational commitment.

(h) Belekoukias [10] studied in the title of "The impact of lean methods and tools on the operational performance of manufacturing organizations". The objective of this research was to investigate the impact of five essential lean methods on contemporary measures of operational performance. Data was collected using survey questionnaire. Data was analyzed using Linear regression analysis, structural equation modelling and correlation analysis. Findings showed that Just in Time and automation have the positive significance on

operational performance. Kaizen, VSM, TPM have lesser or negative impact on operational performance. It was concluded that the prevention and elimination of quality defects has a positive impact on the quality, speed, dependability and cost performance of organizations. Future research should be carried out with a focus on not only the manufacturing industry but also on other industries where the lean strategy can also be beneficial. Future empirical studies can also follow a mixed method approach involving quantitative and qualitative data sets that could be tested through rigorous statistical methods, including the conduction of a non-response bias test in order to ensure a higher confidence in the data collected. A higher response rate and a mixed quantitative-qualitative approach with strong statistical analysis method may allow the generalization of the findings in similar studies. Finally, an analysis of results and drawn of conclusions from a more specific level's view point (i.e., considering industrial sector, company size, length of time of the lean initiative) could also be carried out [11].

(i) Iranmanesh et al. [12] did study in the title of "Impact of Lean Manufacturing Practices on Firms' Sustainable Performance: Lean Culture as a Moderator". The objective of this research was to examine the effect of lean manufacturing practices on firms' environmental performance by considering lean culture as a moderator. Data was collected using survey questionnaire. Data was analyzed using partial least squares technique. Findings showed that process and equipment, product design, supplier relationships, and customer relationships have a positive impact on sustainable performance. It was concluded that sustainable performance of manufacturing industries can be improved by implementation of lean manufacturing practices.

(j) Marshall et al. [13] Studied in the title of "Impact of Human Resource Management on Lean Success". The objective of this research was to investigate the relationship between human resource performance management and lean transformation success by conducting a survey of diverse organizations in various stages of lean transformation. Data was collected using interviews and web-based survey questionnaire. Data was analyzed using Partial Least Squares path analysis. Findings showed that investing in training and development of human resources will lead to long term economic value. It was concluded that there is a significant relationship between selective hiring practices, employee development, and the first-order constructs of lean transformation success.

(k) Khan et al. [14] studied in the title of "Impact of Continuous Improvement on Organization Performance Insight from Pakistan: An Empirical Study". The objective of this research was to identify the impact of continuous improvement on organization performance. A survey method was used for empirical investigation and online survey questionnaire & interview technique were used to collect data. This was an exploratory research survey and cluster sampling technique was used. Factor analysis and multiple regression using descriptive statistics were used for data analysis. This study concluded that competitive advantage can be gained by organizations that implement continuous improvement. The outcome of the study was that innovation, increasing efficiency, reduced defect rate has greatest influence towards continuous improvement. One should take care while generalizing results, as there were limited number of respondent's cities.

(l) Salim et al. [15] studied in the title of "The Role of the Lean Management in Promoting the Creativity of Jawwal from the Point of View of Its Employees". The objectives of this research were to identify the impact of Lean management in achieving creativity among the employees of Jawwal organization, to determine the employees' ability to achieve creativity in different dimensions like decision making, problem solving, accepting risk, to demonstrate the availability of the use of Lean management tools, to identify the creative factors availability. Descriptive analytical method was used. Data was collected through questionnaires and secondary sources. Single sample T test was used to analyze the questionnaire. It was found that there was an impact between flexible management tools and achieving creative elements through Six sigma. The culture of creativity and waste reduction should be developed among employees through continuous improvement, more attention should be given to Six sigma tool for avoiding deviations, promote standard work, create good organizational climate for encouraging innovation among employees. It was concluded that Lean management plays an important role in enhancing the creative factors. The study was limited to workers in Jawwal.

(m) Parv et al. [16] studied in the title of "Continuous improvement processes using Lean management tools: A case study. The objectives of this research were to know how Lean management can be applied in the university setting to improve the management process, to evaluate the implementation of Plan, Do, Study, Act cycle in the University. Questionnaire based survey tool was used to collect the data. Improvements were mapped through Standard Lean tools. The improvements were centered on the PDSA Improvement cycle and aligned with the students' needs. It was concluded that standardizes the good practices towards continuous improvement. Positive results were obtained through strong academia-industry relationship, project-based learning, internships, capstone project and by providing students and faculty with real life projects.

(n) Khan et al. [17] studied in the title of "Application of continuous improvement techniques to improve

organization performance". The objective of this research was to analyze, study and implement continuous improvement techniques in an interior design case company. Data was collected using interviews and questionnaire. Problems were identified and analyzed using Pareto chart and cause and effect diagram. Identified problems were improved using Continuous improvement tools like kaizen, 5S, pareto methods. Findings showed that habit of organized, tidy and clean workplace has been developed among workers. Findings showed that successful implementation of continuous improvement methodology reduced project in pipeline time from sixteen weeks to nine weeks, profit margin has been increased from 25 to 27 percent, sales win ratio increased from 11 to 32 percent and better financial forecasting. It was concluded that the implementation of continuous improvement methodology contributed significantly to time and efforts saving in accomplishing different tasks in the case company, proposed solutions were feasible and practical. Limitation of the study was that the results of this study cannot be generalized to the other industries and sectors. Another limitation faced during the study was that the Employee training to work in Continuous Improvement environment required both time and money, in addition to the costs of training to perform the main job.

Fig. 1 Conceptual Frame Work

(a) To perform a review of literature Lean Management.
(b) To examine the advantages and disadvantages and the issues associated to the adoption of Lean Management Practices in business establishments based on the survey and make conclusion and suggestions.

IV. Statement of Problem

Due to heavy competition in their respective fields and because of several factors, such as technology change, change in taste and fashion through the arrival of globalization, many organizations are fronting distinct challenges. The dismissive impact of this globalization has led to low performance which by addition had exhausted customers satisfaction level in these industries. The low performance level provoked by globalization leads to penurious delivery of products to target customers.

To apply the method of Lean Management is one of the manageable methods for communicating the matter of customers' satisfaction. As a result, manufacturing industry and other sectors may attain its set objectives through the adoption of lean management practices to eliminate poor delivery system by eradicating waste and concurrently generating value for service delivery to target consumers and by addition to improve organizational efficacy and coherence. Lean management has fascinated huge interest from both academics and practitioners. The most technical facets of lean management have been largely considered and it has become an omnipresent production method around the globe such as Toyota and other companies have successfully executed it. Nevertheless, lean management commenced in the automotive industry, it has been applied in other disciplines successfully as well. Lean management has become a production method for many organizations to go after due to the intensified provocations from universal competitors.

Furthermore, research on evaluation of lean management applications and its performance in the service sector is bounded. The approach and methodology in which lean management is executed in service sector vary from manufacturing.

Fall down of firms to incapacity to prosper a method such as lean management practice that can keep up organization to reduce cost and wastage. This forms the base of this study which evaluate the abstract foundation that could uncover it to the world business domain.

V. Findings & Conclusions

The literature survey showed that Implementation of Lean management in manufacturing and non-manufacturing industries improves work productivity.

Survey also showed that when Lean management practices are successfully executed through effectual planning and implementation the subsequent outcomes should be comprehended. These include: diminished lean time, decreased work in progress, enhanced flexibility, minimized transaction, boosted communication, lessened cost, better on-time deliveries, Improved sales, and it upgrades space utilization.

From the literature survey it can be concluded that for every industry and organization, it is required to adopt lean management practices to achieve competitive advantage and remain profit-making worthwhile, and thus enhances customer gratification. Fundamentally, lean management was carried out to decrease waste, inventory depletion, diminished lead time, less rework and financial savings of any industry that endorsed the lean management practices.

Executing Lean Management practices enhances business competitiveness by eliminating wastes while improving quality and customer gratification which include delivery time. Even though, the Lean Management practice surprisingly applied only in the manufacturing sector, but literature has revealed that Lean Management can be implemented in other sectors as well.

In the era of stringent global competition and increasing cost on the local environment, this review suggests that manufacturing organizations and service industries need to adopt lean management practices. To get rid of wastes and enhance organizational productivity, organizations and industries around the world, Just in Time, Heijunka and Jidoka principles which comes under lean management tools are need of the hour.

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Role of Digital India in Achieving Sustainable Development

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Abstract- *India is one of the populous democratic countries in the world and is a developing Country in terms of Economic Growth, Rapid Urbanization, Advancing itself in Defense and other Modern Technologies, etc. To support this Developing Country, 'Digital India Programme' is a Visionary Programme launched in 2015 by Government of India to transform India into a digitally Empowered Society. The main motto of the 'Digital India Programme' is to connect all the rural areas in India with Digital Networks thereby enhancing transparency in Governance. Totally, there are 107 Initiatives under this program that is helping India to transform to a Digital Country and many of the Initiatives are in the verge of completion. At this stage of COVID 19 Pandemic, this program is supporting Indian Government to reach citizens with ease thereby helping citizens to get benefits directly. Primarily, Digital India Program established the required 'Digital Infrastructure' to provide Digital Empowerment and required Services to Citizens and today, in this period of COVID 19 Pandemic; the established robust Digital Infrastructure is supporting several crores of citizens across India. With Digital India Initiative supporting Indian Government to reach the Citizens with ease, this paper focuses on highlighting the role of Digital India Program in Achieving Sustainable Development of India.*

Keywords*:* Digital India, Digital Infrastructure, Sustainable Development

I. Introduction

To facilitate Government Services, reach common man without any hassle, Government of India introduced the 'Digital India' Program' (Digital India, n.d.). The focus of this program is to build the required Digital Infrastructure across India so that Government's benefits to the Citizen can be done electronically. In this regard, Ministry of Electronics and Information Technology has improved online Infrastructure of India drastically by increasing Internet connectivity. The Digital India Program was launched on 1 July 2015 and is facilitating other visionary Initiatives of Government of India like Bharat Net, make in India, Startup India and Standup India, Industrial Corridors, Bharatmala, Sagarmala, etc., It is one of the programs initiated to achieve Sustainable Development of India. Some of the Notable Digital India initiatives include Implementation of Aadhaar Digital Biometric Identity Cards, National Mission on Education using ICT, PAHAL (DBTL) to eradicate bogus LPG Connections, Pradhan Mantri Gramin Digital Saksharta Abhiyaan to enhance digital literacy in rural areas, Smart Cities, etc., In total, 107 Initiatives are initiated to empower India digitally, thereby achieving Sustainable Development [1-4].

II. Digital India Program – A Snapshot

Digital India Program is implemented through three broad areas as shown below. Digital Infrastructure having 29 Initiatives is the primary pillar that ensures the required Digital Infrastructure is kept ready for carrying out Digital Services and Empowering Citizens Digitally as shown in fig.1. The other two pillars include Digital Services and Digital Empowerment having 62 and 16 Initiatives respectively [5-9].

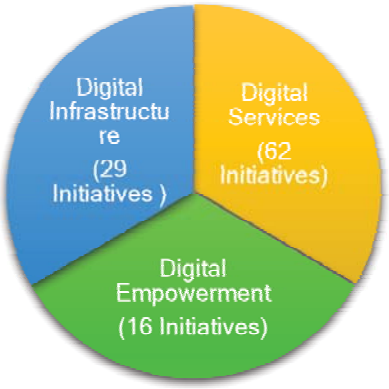

Fig. 1 Digital India - Conceptual View

(a) **Digital Infrastructure** is the pre-requisite for enabling Digital way of working. Under this Pillar, 29 Initiatives are functioning to create the Digital Platform for India. Some of the notable and successful Digital Infrastructure Initiatives include Aadhaar to provide unique identity card to every Indian Citizen, Deen Dhayal Upadhyaya Gram Jyoti Yojana to provide continuous power supply to rural India, Digilocker to empower citizens digitally, Integrated Health Information Platform to create Electronic Health records of Citizens, Open Data to publish datasets for public use, Direct Benefit Transfer to facilitate delivery of government welfare schemes, E-Trade, etc.,

(b) The basic purpose of Government of India to initiate the Digital India Program is to provide the **Government Services to Citizens** with ease. In order to ensure this objective is met, 62 Initiatives are functioning under Digital Services Initiatives. Some of the notable initiatives in this category include Accessible India Campaign to support specially challenged people to get equal opportunity, Beti Bachao Beti Padhao to support girl child education, Crop Insurance Mobile App to support farmers, e-Granthalaya supporting digital library, Startup India, Swatch Bhaarat, Farmer Portal,

Goods & Service Tax Network, Himmat to support women during emergency, etc.

(c) **Empowering Citizens digitally** is yet another key aspect of Digital India Program. To achieve this objective, 16 Initiatives are functioning and some of the notable and successful Digital Empowerment Initiatives include Aadhaar Enabled Payment System, MyGov to promote participation of common citizen in governance, PAHAL to eliminate duplicate LPG Connections, Pradhan Mantri Kaushal Vikas Yojana to promote Skill Development, Smart Cities to promote sustainable and inclusive cities, Visvesvaraya PhD Scheme for Electronics and IT to encourage working professionals to pursue PhD, etc.,

III. Role Of Digital India In Achieving Sustainable Development

Sustainable Development aims at protecting the planet, end poverty and make this earth a pleasant place to live peacefully and prosperously. All the 17 Sustainable Development Goals (SDGs) of United Nations aims at sustainable development socially, economically and environmentally (United Nations Development Programme, n.d.). The 17 SDGs are integrated in such a way that the overall development is balanced. NITI Aayog of India has mapped the various initiatives of Digital India Program to achieve the various Sustainable Development Goals (NITI Aayog, August, 2018) as explained below Table 1.

Table 1: Sustainable Development Goals (NITI Aayog, August, 2018)

S.No	Sustainable Development Goal	Digital India Initiative	Role of Digital India Program in Achieving Sustainable Development
1.	No Poverty	Pradhan Mantri Kaushal Vikas Yojana	This DI Initiative focuses on developing Skill of citizens, thereby eradicating Poverty
2.	Zero Hunger	Pradhan Mantri Jan Dhan Yojana	This DI Initiative aims at financial inclusion and directing the Government benefits to the needy, thereby removing hunger
3.	Good Health and Well being	• NIKSHAY • Targeted Public Distribution System • Mother & Child tracking system	These Initiatives are intended to distribute quality food grains to poorer and improve their health and well being
4.	Quality Education	• National Scholarship Portal • National mission on education using ICT, E-GRANTHALAYA, SWAYAM • Visvesvaraya PhD scheme	These Initiatives intend to benefit learners and improve their quality of education
5.	Gender Equality	• Beti Bachao Beti Padhao • HIMMAT	Initiatives focusing on Womens
6.	Clean Water and Sanitation	Swatch Bhaarat App	Initiatives to make Clean and Green India
7.	Affordable and Clean Energy	National Ujala Dashboard	Initiatives aimed at Efficient management of Energy
8.	Decent Work and Economic Growth	• National Career Service portal • Crop Insurance mobile app	Initiatives helping Job Seekers
9.	Industry, Innovation and Infrastructure	• MCA21 • Aadhaar Enabled Payment System • PayGov, BHIM • Passport Seva project • DIGILOCKER	Initiatives aiming to promote Industrial Growth and providing required Infrastructure to Citizens

S.No	Sustainable Development Goal	Digital India Initiative	Role of Digital India Program in Achieving Sustainable Development
10.	Reduced Inequalities	Accessible India campaign and mobile app	Initiatives to help specially Challenged Citizens
11.	Sustainable Cities and Communities	Smart Cities	This Initiative focuses on developing Sustainable and Inclusive Cities
12.	Responsible Consumption and Production	PAHAL (DBTL)	This initiative aims to eliminate bogus LPG Connection such that the needy consumers will get the benefits
13.	Climate Action	UJJWALA	The goal aims to adapt to the climate change and invest in low-carbon development
14.	Life Below Water	ESSO - Indian National Center for Ocean Information Services	This aims to sustainably manage and protect marine and coastal ecosystems from pollution, as well as address the impacts of ocean acidification.
15.	Life on Land	• Heritage City Development and Augmentation Yojana (HRIDAY) • ICDS Systems Strengthening and Nutrition Improvement Project • Small Farmers Agribusiness Consortium • Farmer Portal	This aims to reduce the loss of natural habitats and biodiversity, Climate Change Mitigation and support global food and water security.
16.	Peace, Justice and Strong Institutions	Crime and Criminal tracking network & systems	Initiatives under Peace
17.	Partnership for the Goals	EGREETINGS	Initiatives to promote partnerships

IV. Conclusion

With Google announcing to invest Rs. 75000 Crores into Digital India Program for the next 5-7 years, Digital Economy in India is not a vision but a reality (Financial Express, July 14, 2020) We believe that the Digital India initiative not only brings transparency in Governance and help the needy at the right time, it also helps in boosting nation's economy and provide large number of employment prospects to the youth. The mapping of the Digital India Initiatives to 17 SDG's by NITI Aayog helps India to achieve Sustainable Development at a much faster rate. Some of the Initiatives require some transformational process, reengineering, refinement and adjustment to the existing process and practices to achieve the desired objectives. These objectives can take jet speed with the participation of Indian Citizens and other stake holders of our nation to create a sustainable future. There are still concerns on Data Security and Privacy and necessary steps are taken to ensure these concerns are resolved (Business Line, July 14, 2020). In Conclusion, Digital India is having a great impact on the future of Indian citizens and Economy of our nation. So, let's join our hands and move forward for the brighter and prosperous India.

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Agriculture Education for Rural Development in Jharkhand

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Abstract- *Rural development is a strategy for reducing poverty and to uplift socio-economic infrastructures in rural areas especially through agriculture development which is almost impossible without proper management of agriculture graduates and trained farmers. An attempt is made in this paper to examine the transformative role of responsible public and private mechanism, skilled farmers and agriculture graduates for achieving ultimate goals and objectives of agricultural policies and rural development efforts during various plan periods. Most of agriculture graduates have to be encouraged to work with farmers and need to be devoted in agricultural based occupations. This situation suggests that the state is still potential destination form the perspectives commercial farming and agricultural transformation. The government need to give excessive emphasize to providing accessible and affordable agriculture education opportunities to socio-economically backward students whose family members are still working in agriculture sectors. The government needs to expand agricultural service delivery mechanism and mobilize agriculture graduates and post graduates in remote areas. The private sectors also need to invest in agriculture sectors for the people struggling against food insecurity.*

Keywords: Agriculture education, agriculture development, strategy of agriculture, rural development.

I. INTRODUCTION

Jharkhand was formed as the 28th state of India on 15th November 2000 through the Bihar Reorganisation Act. It is spread over 7.97 million ha with a population of 32.97 million. Nearly 70% of the population of the State is dependent on agriculture. The state receives annual rainfall of 1200-1600 mm and the climate ranges from dry semi humid to humid semi-arid types. Out of the average annual precipitation of 10 Billion Cubic Meters (BCM) that the state receives, about 15% is lost in the atmosphere and 50% flows out as surface runoff. Thus, 35% of the total precipitations recharge the ground water [1]. In general, the soils of Jharkhand are low to very low in available phosphorus and sulphur, medium in available nitrogen and potassium status and deficient in available boron. About 1.6 million ha (19% of total geographical area) is acidic. The region has a major problem of slight to moderate soil erosion as 74% of the areas are located on very gentle to gentle slopes.

Despite good rainfall, the cropped area and cropping intensity are low. The level of technology adaptation is also poor leading to lower productivity.

The net sown area is 2.56 million ha and only 12% of cropped area is under irrigation. The total cultivable land in the State is 52% as compared with 55% of the country, but only 43% area of this is under net sown area compared to national average of 76%.

Jharkhand is known for mono-cropped rice cultivation under rainfed condition. Occurrence of frequent drought at intervals, low rainfall, long dry spell during crop season leads the farmers to shift towards low water requiring crops like Pulses, oilseed, Vegetables and cereals like Ragi and Jowar. With the increase in irrigation potential farmers used to grow 2-3 crop depending upon the situation [2].

The state of Jharkhand is rich in natural resources but agriculture lacks technological intervention. One of the main reasons is it lacks quality educationists and Research and Development.

II. RURAL DEVELOPMENT PERSPECTIVES

(a) Theoretical Perspectives - Agriculture education and rural development in state of Jharkhand can be the best foot forwarded from agriculture transformation and modernization. In this theory, Nobel laureate economist (1979) Theodore William Schultz emphasized that key to agricultural transformation lies in introducing new plantation technology, better species, more effective power sources and cheaper fertilizer that is, emphasizing technological change in agriculture. According to the conception of this theory, Schultz has given more focus of following: -

i. More resources should be given to agriculture.
ii. The manufacturing and other urban sectors should not be subsidized at the cost of rural areas.
iii. As a tool employment- based strategy should have following three elements: -

- Accelerated output growth to raise the productivity of small farmers.
- Raising domestic demand for agriculture products.
- Diversified and non-agriculture labour -intensive rural development activities supported by the farming community be encouraged.

This modernization theory provided a conceptual structure for the analysis and explanation of modern farming system in fifties and six tees. The main problem and modifying agricultural practices relate to dissemination process, which faces social and cultural obstacles in adoption of new techniques and products. The traditional attitudes and conservative value come on the way. Communication, transportation, education, media (print and electronic media), local leaders, development agent's, geographical factors etc., may help transferring new technology in rural society.

(b) Policy Perspectives Policy reforms and economic growth have been changing demand and supply fundamentals making agriculture. Market – driven sector.
In India, agricultural development is now being seen as an important part of agriculture education. The agricultural sector is now a key area for the achievement of development goals. Agricultural education in tune with fast changing national and international scenario has become important. Future agriculture is dominated by dangers of food insecurity, stagnating/declining productivity and profitability; degradation and depletion of natural resources; increased risks due to changing climate; unsafe livelihoods for millions of small and marginal farmers; regional imbalances in agricultural productivity; rising input costs, unsound profits and vulnerable markets; changing food habits and quality concerns; high post- harvest losses and fragmented processing industry; globalization of trade and commerce; weakened technology transfer system; fossil fuel crisis and growing emphasis on bio-fuels encroaching upon good agricultural lands; poorly coordinated natural disaster management system, and the looming prospects of bioterrorism etc [3].

The State of Jharkhand has a fairly high potential for development of agriculture in general and in particular for cultivation of certain high value agricultural crops including fruits, flowers and vegetables in view of the favourable climatic conditions. Despite these advantages, development of agriculture and adoption of modern technologies has not really taken off in the State. Consequently, production and productivity are below the national averages in case of most annual crops. The focused areas as per the policy document the Govt. of Jharkhand are: -

(i) Development of strategies for agriculture to provide sustainable livelihood opportunities to the people for overall economic, social and human development.
(ii) Ensuring food, nutrition and economic security through development of agriculture in terms of food grain, oilseed, horticulture, cash crop, livestock, fishery and agro-forestry.
(iii) Efficient and sustainable use of soil, water and biodiversity.
(iv) Provide sustainable income generation activities to the farm families.
(v) Linking food production with agro-based industries like.
(vi) Agricultural education to produce graduates and skill development through training.

III. Rural Development Needs

Rural development in Jharkhand involves interaction of economic, social, political and various cultural factors. Due to reasons like unstable political situation, absence of people participation and poor mobilization of youth in agriculture and rural development sectors development has not been satisfactory.

Effective agriculture education and rural development providing skill and training with placement can empower young people of Jharkhand. Awareness as regard to following can be helpful: -

(a) Inadequate availability of seed and planting material, in general.
(b) The fertilizer consumption is very low, i.e., 33.52, 17.39 and 4.82kg/ha, respectively, of nitrogen, phosphorus and potassium. Low availability of boronated SSP and slow-release fertilizers.
(c) Large dryland area and lack of high yielding crop varieties
(d) Poor crop management, low input use and inadequate crop planning.
(e) Poor watershed management systems. Excessive use of insecticides and fungicides, especially in vegetable cultivation and other crops resulting is health hazards.
(f) Non adoption of modern technology and lack of awareness among the farmers.
(g) Lack of organized marketing facilities, and absence of effective value chain management.
(h) Infrastructure, roads, communication, power supply, storage, processing and marketing facilities for agricultural produce is poor state. Organic farming not taken up.

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Covid-19 and Educational Scenario in India- An Overview

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Abstract- *The COVID-19 pandemic, also known as the coronavirus pandemic, is an ongoing global pandemic of coronavirus disease. 2019 (COVID- 19), caused by severe acute respiratory syndrome. Covid pandemic has totally changed the dynamics of the world but education sector is one of the worst hit segments in India. With spread of COVID-19, normal functioning of educational institutions got badly affected. In higher education, the classes were suspended around 16.03.2020 onwards, and the students were asked to vacate the hostel. It was very tough time for students as most of them had just returned from their homes after the Holi holidays, and a few had still not come back. The medical experts and scientists are working world-wide to develop a vaccine to control the pandemic, but useful results are likely to take longer time. Definitely, the society has to get accustomed to live with the corona virus following the guidelines issued by the Government from time to time. The activities can also be modified, and can even be postponed, if possible, to save people from getting infected from the disease. Amid an unprecedented corona virus crisis across the world, in India, a discussion about online education has now acquired paramount importance in terms of reliance on imparting knowledge* virtually, *compared to the conventional method of face-to-face teaching. Our education structure is different and only limited people have access to digital media. We can enter into this model of education if all the students have access to internet and computers. But that is not the case. This paper examines status of education under lockdown.*

Keywords – Covid 19, online education, Conventional Education

I. INTRODUCTION

In Higher Educational Institutions (HEI) the annual or the even semester examinations are conducted in the month of May every year. This year due to COVID-19, the academic activities suffered badly. Efforts were made to conduct online classes for theory subjects. Also, exercises were given to students in lieu of practical classes, seminar, project work etc. Although there have been limitations of resources and poor internet connectivity with the students staying in remote locations, resulting in inadequate delivery of contents, yet many remained connected to academic activities to a larger extent [1].

With a view to understand the educational problems under lockdown, consultation was done with a number of people from academia. Findings as regard to the Status of online education under lockdown and Status of conventional education have been analysed to know the effectiveness of online education in prevailing situation [2].

II. STATUS OF ONLINE EDUCATION UNDER LOCKDOWN

Universities, colleges and schools across the country have been closed since March 16, 2020 when the Union Government announced a countrywide classroom shutdown as one of the major measures to contain the outbreak. Later, a nationwide lockdown was announced.

Most governments around the world have temporarily closed educational institutions in an attempt to contain the spread of Covid-19 as of 7th June, 2020 approximately 1.725 billion learners are currently affected due to school closure in response to the pandemic. According to UNICEF monitory, 134 countries are currently implanting nationwide closures and 35 are implanting local closures, impacting about 98.5 percent of the world's student population. The world has never experienced such a dramatic impact on human capital investment and the consequences of COVID-19 on economic, social and political indicators.

Although majority of the governments are making substantial efforts to ensure online educational opportunities, their capacity for the most disadvantaged populations varies enormously. The responses vary widely by level of income: less than 25 per cent of low-income countries currently provide any type of remote learning, and of these, the majority are using TV and radio.

In contrast, close to 90 per cent of high income countries are providing remote learning opportunities, nearly all of which are provided online. A lower share of lower-middle income countries – 66 per cent – offers online or broadcast remote learning opportunities to their students. But even when governments of low and middle-income countries try to offer online education, they will not be able to reach most students: Only 36 per cent of the residents of lower-middle income countries have access to the internet.

The learning gap between rich and poor will likely grow during the pandemic, not just between high and low-income countries, but also between high and low-income regions and communities within countries.

There are some predictable risks. **One very real risk is exacerbating existing inequities.** Today for students who do not have access to technology, books, food or literate adults at home, remote learning runs the risk of drastically widening the gap between haves and have-nots of those resources.

A panel appointed by the UGC has recommended that the academic session in universities and higher educational institutions can be started from September, 2020 instead of July. 2020 in view of the COVID-19 situation in the country.

Many institutions swiftly and efficiently shifted online after the lockdown but many students have complained about having little or no access to the internet and have raised their issues with their colleges too. This points out that the results of the survey could easily reflect the conditions in the rest of the country and could be something that the state and centre should take into consideration as well.

The situation of every student is different, including the rate of COVID-19 infections. Also, some universities may be small and be able to provide online facilities to all students. Others have thousands of students and fewer resources. **We cannot mandate one standard solution to all.**

III. School Education

Apart from university education, the school education has a different picture of its own. The lives of children are now heavily altered without play and peers and schools. In India, 41 per cent of the population is less than 18 years of age. Closures of school may protect the school children from corona virus but the impact on them is going to be detrimental. Children are losing out on their daily interactions with their schoolmates and teachers and it will be long before they go back to school.

Learning is certainly going to be disrupted, more so for children whose parents are not literate or who do not have access to internet-based learning. There is no certainty as to when schools will resume; a prolonged gap is going to affect children's interest and ability to go back to learning. If schools continue to be shut down for a long period, education is going to be a casualty.

ICT is emerging as an alternative, its potential as a tool to reach education to primary and secondary grade children is being explored. It may look a good option for the middle class children, but not for others.

The lack of android phone at every household and availability of quality e-materials in regional languages are another bottleneck.

School closure also means loss of the midday meals. This, for poor children is going to be distressing, furthering the existing hunger and malnutrition. It is the poor and marginalized children who are going to be most affected by the lockdown. The impact of the pandemic on children is insidious and going to be long lasting. The visuals of huge groups of migrants walking back to their villages, with children in tow, are heart-wrenching.

International Labour Organization (ILO) estimates that 40 crore workers in the informal economy are at risk of falling deeper into poverty during the corona crisis. **Loss of livelihood is going to leave a deep impact on children,** there will be less to eat, more children will be pushed out of school and there will be many more children who will go to work.

Some children have already started working with their parents on farms, and in non-farm activities; some are found assisting in small grocery shops or selling vegetables in local markets. The situation is dire, the impact of the pandemic and the lockdown on children has to be understood and acted upon.

IV. Status of Conventional Education

Under corona pandemic lockdown, if we talk about conventional education, it does mean that the plight of the majority of the Indian children along with the children of the other countries of the world needs to be seriously taken into account.

The world today faces a global learning crisis, with the *2030 Sustainable Goals for Education* far from reaching the goals. Though many of the world's children are in school today, 263 million children remain without access. For the children and young people that are in school, they are often not really learning.

Poor quality schooling is an issue in all countries but is more pronounced in developing countries and for the most marginalized children. In India too, the quality and pace of the learning of the majority of the children in public education system is very slow. One can see ASER Reports. If we talk of absence of 4Cs – communication, collaboration, creativity and critical thinking – in the online learning approach, all these are equally absent in the present day classroom teaching-learning process. **Learning and teaching are not two sides of the same coin.**

Learning is a process that takes place in a living organism; as a result of it, the behavior of the organism changes. This process is the object of psychological research. The role of teaching, on the other hand, is to organize the environment in such a way as to enable learning to take place. In order to organize the environment, we must know the conditions under which learning takes place. Instruction, according to its own logic, may reject certain learning activities (such as indoctrination or conditioning) and approve others (such as learning by discovery or learning based on understanding).

Once instruction has approved certain kinds of learning, psychological research into them should dictate the activities of instruction (Lamm, 1976, p. 188, 190). If all these are missing for the children, school is rigid, uninteresting and ultimately alienating. The result is the mismatch between the learner and educator. **But it is not the children who are mismatched to the schools; rather the schools are mismatched to the children.**

This divergence between our children and our educational practice needs a drastic educational reform that will bring the classroom to accord with society. Only by

revising educational practices, can we close this gap, and reunite our schools with our children and the rest of our country. The constructive theory provides a foundation for such changes, and the time to implement them is now.

V. REVISIT THE POLICIES

The upheaval caused by the novel coronavirus should inspire a basic review of past choices and policies. Some of these policies had gained so much acceptance that one felt there was no point in questioning them.

Public health and education are two areas in which India took decisive turn in the 1990s. When several states decided to stop giving permanent appointment letters to doctors and teachers in the mid-1990s, they were guided by an ideological shift at the national level towards allowing health and education to be opened for private enterprise. This was viewed as a major policy reform, a necessary part of the bigger package of economic reforms. They were presented as a package, offering little choice for specific areas.

The new buzz has been public-private partnership. It covered everything from roads to schools. The form it took made it amply clear that the state would take a back seat after issuing a set of rules for private operators while the state's existing infrastructure is appropriated and will gradually shrink. Soon enough, cost-effective measures became the priority in both health and education.

As we begin to imagine the post-coronavirus scenario, **a key question to contemplate is whether we should revisit the policies put in place ever since the 1990s.** Some will doubtless argue that the clock cannot be put back and that we should not waver from the path we had chosen, no matter what hardships people have to endure.

Certain policies were specific to domains such as health and education. Others were more like frameworks within which policies for specific areas emerged and evolved. One such framework had to do with villages. Special measures were designed to select the 'best' among rural children and make them competitive enough to survive in the urban world that was treated as mainstream.

VI. EFFECTIVENESS OF ONLINE EDUCATION WITH SOME SUGGESTIONS IN TERMS OF ALTERNATIVES TO IT

I'm really grateful to my friends who include teachers, teacher educators, academicians and social activists for sharing their personal experiences on the basis of which I have been able to contemplate on online education during corona lockdown. Though I was looking for some alternatives to online education during lockdown, I have received mixed responses and reactions and some suggestions in terms of alternatives to online education during lockdown.

Deliberations in the present context remind us that a child's learning occurs in many different ways: in whole group activities, in small group situations, in one-to-one exchanges with the teacher and other children, and as an individual. A fundamental aspect of a supportive classroom is that the teacher attempts to monitor learners in all of these learning situations and attempts to offer support which *meets the diverse needs of each learner.* This is almost impossible in online education.

It is important to keep mind that technology is merely a learning medium. It can be a bridge, never a destination. Computers may *help* the students learn but it cannot *make* the students learn. If learning is the heart of the world of education, even in digital form, the teacher is its lifeblood. In fact the teacher, not the technology, is the key to the future. Without good teachers we have no future.

Big guns are advertising in the media and a market for education in digital mode is being pushed. India cannot afford to provide primary education in virtual mode. Even those who afford will not be benefited except a small proportion of children from elite families where parents are highly educated. The poorer and rural children will surely suffer, as even now, with direct face to face teaching, they are learning and performing poorly, as so many NCERT surveys and ASER reports indicate.

Online education is being proposed not merely as an interim solution, but as a possible substitute to conventional academic mode. If it is pursued after the lockdown is over, it needs to be resisted by teachers as well as parents. Concluding his views the activist says that we already have a pedagogic and political culture of silence and suppression of dissent. And it may be aggravated in coming times, we need to keep eyes open, and observe how all this evolves.

Dr. Anil Kumar Roy, General Secretary, Bihar Social Science Academy, opines that since the government functions as a manager of the system, not only corporate institutions, but the government also advocates online education. This is clearly visible in the New Education Policy.

Coronavirus lockdown is an excuse or just an alibi to introduce online education. In the absence of corona, certainly it might have faced some obstacles to go ahead, but corona pandemic has provided an ample opportunity to the dispensation to go ahead with online education unhindered. It goes without debate that online education cannot replace conventional mode of teaching-learning process. Dr. Roy further suggests some alternatives to it: in the prayer-time assembly quick-result-test should be administered on children every day; physical distancing should be maintained in the classroom; games should be allowed without physical touch and sanitizers and mask should be provided to the children.

Some teacher educators opined that people with disabilities mostly fall under the category of vulnerable

groups. In academia, people with disabilities face many problems related to accessibility and learning resources. In a country like India, major population resides in remote areas having less connectivity to internet.

While focusing our attention towards Union Territory of Jammu and Kashmir, theoretically everything seems to be perfect but practically things are not so easy, specifically in Jammu region. With 2G mobile connectivity in Jammu, its's virtually impossible to conduct classes as it takes hours together to get the requisite material loaded online. Some teachers and students are lucky enough to have broadband, fiber or FTTH connections but majority of students simply don't have access to smart phones leave alone these high speed connections. Internet is no more a privilege, but a necessity. In this digital age certain rural areas of Jammu Division don't have mobile connectivity at all. With no access to internet a student risks missing out classes altogether. With only one laptop or mobile in a family, especially if there are multiple siblings, it becomes more complicated if parent is also teacher and assigned to conduct online classes tend to clash and students don't show up.

Even teachers need time to adapt to digital learning as some concepts need visual aids and innovative ideas to make children understand topics. Kindergarten and lower classes are exempted in some schools. Students have been using language, expressions and gestures which must not be used before anyone, let alone a teacher. Many teachers are extremely conscious about what they are wearing and how they present in front of the screen. The suddenness with which teachers have been plunged into online teaching amid the lockdown means they did it with little preparation. Many schools also have no clear markers for how much they were trying to achieve through this changed process. Online classes might last for four hours but teachers are putting in almost the same amount of time preparing assignments which are not just useful but should also be pretty. Low and irregular attendance, lack of attention by students; the fear of technology (especially among older teachers), poor internet connectivity and in most cases, the added pressure of household chores, have made online teaching a dreaded activity for many teachers. Schools want to be perceived as giving their best to students-a burden that is unfairly borne by teachers more so than in normal school days.

VII. Conclusion

To conclude, a question automatically crops up: How far *'stop classes without stopping learning'* may be successful in India? Some teachers may grow stressed dealing with the challenges of online teaching including the lack of face-to-face interaction and sometimes unreliable technology. During this short period of time, the challenges would be two-fold: online platforms should include multiple options for meeting practical teaching needs, such as synchronized video and voice for group learning and classroom interactions. However, in poorer or more rural areas, this would be limited by the technological facilities or even the uninterrupted availability and cost of electricity.

We need to think again and again how education can be effective for students' overall cognitive and non-cognitive development with e-learning. It seems impossible, for real learning occurs only when the students investigate a concept, find information, discuss it and create in their own way.

The present education system and the dynamics of a student-teacher relationship are likely to change in the near future. With the way that countries are closing their borders across the globe, Indians in foreign lands are returning to their homeland, and rural migrants returning to their villages, there might be a need to formulate the policies for the majority of the students. While fighting with the virus, we should not forget the invisible children. Children may look less vulnerable from corona but may feel the heat heavily.

We cannot wait for the crisis to be over before we reach out to the children. Children should be ensured nutrition, protection and continuity of education. Discussion on policy, strategies and line of action ought to be continued. Tomorrow will be a new dawn. What we make of it is entirely in our own hands. Undoubtedly Change is desirable and inevitable. Change in fact has been forced upon us due to the onset of Covid 19. Whether we use the opportunity to our advantage or let it pass by will decide whether the future will be a better tomorrow.

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Impact of Government Initiatives on Entrepreneurship Development in Jammu and Kashmir- A Case of Mashroom Farming

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Abstract- *In India, Jammu and Kashmir is known for its Mushroom Cultivation. Owing to the favorable climatic conditions, there have been several recent reports of increase in profitability of farmers involved in mushroom cultivation while many have found it to be a new source of income. SinceGovernment of India is taking lot of initiative on the direction of developing entrepreneurship inJammu and Kashmir and at the same time mushroom farming is emerging as booming entrepreneurial options, it is imperative to study the impact of government initiatives on entrepreneurship development in Jammu and Kashmir in the field of mushroom cultivation. For this, a quantitative analysis has been conducted in the present research. Herein, primary data has been collected using survey strategy for which a structured quantitative questionnaire has been used as the data collection instrument. The study found a significant impact of Government initiatives on development of Mushroom farming as an entrepreneurship option in Jammu and Kashmir.*

Keywords: Entrepreneurship, Mushroom Cultivation, Jammu and Kashmir, Government initiatives.

I. INTRODUCTION

Entrepreneurship is one of the key ingredients in the present times, which contributes maximum to the economic development of a country. Entrepreneurs are not only concerned with their own development and growth but also facilitate in employment generation which then contributes to the economy. Apart from this, entrepreneurship also brings up new and innovative ideas thereby enhancing the business reach for the nation and creating and business environment of dynamism.

India has become home to many entrepreneurs and budding of startups ranging in different product and service industries across the nation. According to Economic Survey 2020-21 presented in Parliament of India, there are 41,061 startups (till December 23, 2020) out of which approximately 39,000 startups have generated 4,70,000 jobs in the country [1]. Moving in the same direction, India has the third largest startup space in the world [2]. Thus, India holds a good position as far as entrepreneurship and startup ecosystem is concerned. Herein, Government of India has played a major role by providing more than 120 schemes for entrepreneurship development in the country across different sectors and domains [3].

Jammu and Kashmir is an Indian union territory having plentiful of un utilized and untapped natural resources making it an emerging golden spot to launch businesses owing. It is an untapped market from the prospective of doing and establishing businesses. Owing to these reasons, it holds a huge potential for entrepreneurships and start-ups to prosper in the area.

II. THE BACKGROUND

(a) Initiatives of the Indian Government- Government of India has focused on to encourage and motivate the young and entrepreneurial enthusiasts of Jammu and Kashmir to follow innovation and entrepreneurship via building a vivacious and favourable Startup ecosystem in the region [4-6]. For the same reasons, Government of India has launched several schemes for the region in order to support entrepreneurship including Seed Capital Fund Scheme, Youth Startup Loan Scheme, Himayat Initiative and National Minorities Development Finance Corporation (NMDFC) schemes [7]. Further, the government has also launched a dedicated online portal called "Startup JK" that provides open access to all the important resources like relevant Government Schemes, Learning & Development program, Market and research reports to all thestakeholders. Further, Government of India is also offering many incentives and assistances in the entrepreneurship support aspects like co-working space, monthly allowance, and energy assistance, international patent filing reimbursement, product research and development / marketing / publicity, tax benefits and exemptions, public procurement and self-certification of compliance under labour law [8].

(b) Scope of Mushroom Farming in Jammu and Kashmir - In India, Jammu and Kashmir is known for its Mushroom Cultivation. It started in Jammu and Kashmir in 1964 by the Department of Agriculture, Lamandi, Srinagar [9]. The reason for huge potential of mushroom cultivation in the region is because of varied agro- climatic conditions and accessibility of raw materials. Mushroom can be grown in all climatic scenarios on a condition that it is provided with appropriate temperature. It is a crop which does not require land to grow and thus, does not disturb the cultivation of other crops or vegetation Asa matter of fact, the climatic and temperature conditions of the region naturally suits the mushroom cultivation [10].
Owing to the favorable climatic conditions, there have

been several recent reports of increase in profitability of farmers involved in mushroom cultivation while many have found it to be a new source of income [11]. According to the Agriculture department, the climatic changes in the region are leading to shrinkage of agricultural land thereby reducing the income of the farmers. On the other hand, since mushroom farming does not require land for cultivation, it can contribute to doubling the income of farmers [12]. Thus, mushroom cultivation can be considered to be one of the most prominent and profitable entrepreneurial options for the people in Jammu and Kashmir.

III. Objectives And Methodology

Since Government of India is taking lot of initiative on the direction of developing entrepreneurship in Jammu and Kashmir and at the same time mushroom farming is emerging asbooming entrepreneurial options, it is imperative to study the impact of government initiatives on entrepreneurship development in Jammu and Kashmir in the field of mushroom cultivation.

None of the researches have been found to focus in this direction. Thus, the present research willhelp filling this gap.

(a) Objective of the Research - The objectives of the present research are as follows-

(i) To assess the impact of Government initiatives on development of Mushroom farming as an entrepreneurship option in Jammu and Kashmir

(ii) To identify the individual initiatives of Government having maximum impact on development of Mushroom farming as an entrepreneurship option in Jammu and Kashmir.

(b) Hypothesis of the Study- The present research has tested the following hypothesis-

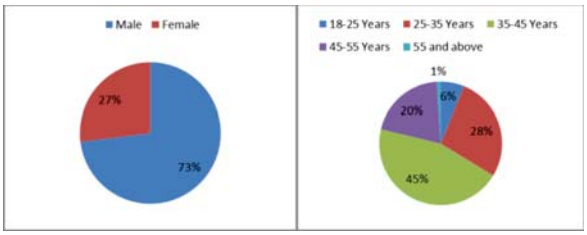
(i) $H_0$1- There is no significant impact of Government initiatives on development of Mushroomfarming as an entrepreneurship option in Jammu and Kashmir.

(ii) H_A1- There is a significant impact of Government initiatives on development of Mushroomfarming as an entrepreneurship option in Jammu and Kashmir.

(c) Methods and Material- For assessing the impact of government initiatives on entrepreneurship development in Jammu and Kashmir in the field of mushroom cultivation, a quantitative analysis has been conducted in the present research. Herein, primary data has been collected using survey strategy wherein a structured quantitative questionnaire has been used as the data collection instrument. The respondents of the study are the entrepreneurial enthusiasts who want to peruse mushroom farming. These respondents were contacted at different mushroom cultivation training workshops and sessions conducted in Jammu and Kashmir during the time frame of January 2021 to April 2021. There email ids were retrieved form these workshops and sessions and questionnaire were mailed in form of Google form links. Approximately 300 questionnaires were received.

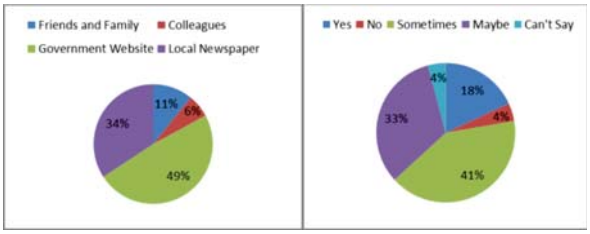
IV. Results And Discussion

Descriptive Analysis- Descriptive analysis has been conducted in the present research to describe the primary datacollected in the present research.



(a) (b)

Fig. 1 (a) Gender of Respondents (b) Age of Respondents



(a) (b)

Fig. 2 (a) How did you came to know about this session/ seminar/ workshop (b) Jammu and Kashmir hasbusiness environment for growth of entrepreneurship

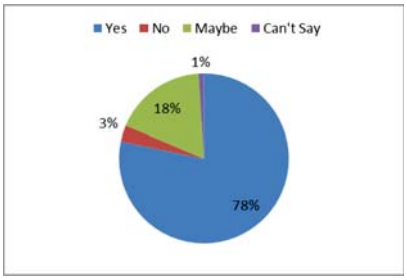


Fig. 3 Awareness about government schemes for Startup and entrepreneurship development in Jammu and Kashmir

(a) Inferential Analysis

The inferential analysis has been conducted to test the hypothesis of the study. For testing this hypothesis, bivariate correlation and linear regression has been conducted asbelow-

i. Correlation Analysis- The bivariate correlation analysis has been conducted to assess the relation between the independent factors (Factors of Government Initiatives) and dependent variable (Development of Mushroom Farming as Entrepreneurial Option) as shown in table 1.

Table 1: Factors and relations

Factors of Government Initiatives	Pearson Correlation	Sig. (2-tailed)
The subsidy provided by Government on mushroom farming	.402**	.000
Financial assistance of Government	.642**	.000
Training programs run by Government	.489**	.000
Tax exemption schemes of Government	.402**	.000
Incentives being provided by government like battery-operated spray pumps, polybags, quality spawn and chemicals	.583**	.000

Table 2: Correlation Analysis

Introduction of new varieties of high commercial importance in mushroom farming by Government	.426**	.000
Seed Capital Fund Scheme (SCFS) of Government	.563**	.000
Youth Start up Loan Scheme (YSLS) of Government	.634**	.000
Himayat initiative of Government	.513**	.000
National Minorities Development & Finance Corporation (NMDFC) of Government	.451**	.000
Tie ups of JKEDI with various other renowned institutes in the country promoting entrepreneurship	.473**	.000
Initiative of Government of India to double the income of Farmers by 2022	.491**	.000

It can be inferred from Table 2 that all the factors of Government initiatives were found to be statistically significant. Further, the strongest relation was found to exist between the independent variable "Financial Assistance of Government" and dependent variable "Development of Mushroom Farming as Entrepreneurial Option" with Pearson coefficient valueof 0.642. Thus, it can be stated that as the financial assistance provided by Government of India increases, development of mushroom farming as entrepreneurial option also increases. In a research conducted by Davari & Farokhmanesh, (2017) on assessing the impact of policies on opportunities of entrepreneurship, it was found that financial support has a positive impact on thegrowth of entrepreneurship opportunities thereby supporting the findings of the present research [13].

Further, a strong relationship was also observed between independent variable "Youth Start up Loan Scheme (YSLS) of Government" and dependent variable "Development of Mushroom Farming as Entrepreneurial Option" with Pearson coefficient value of 0.634. Thus, it can be stated that YSLS scheme is positively contributing to development of mushroom farming as entrepreneurial option in Jammu and independent variables "Factors of Government Initiatives".

Kashmir.

Since all the factors of Government initiatives were found to be statistically significant in correlation, all these factors will be used in the regression analysis to test the hypothesis in the section below-

ii. Regression Analysis - Linear regression analysis has been conducted between independent variable "Factors of Government Initiatives" and dependent variable "Development of Mushroom Farming as Entrepreneurial Option"

Table 3: Model Summary of Regression Analysis

Model Summary	Model	1
	R	.787[a]
	R Square	.620
	Adjusted R Square	.595
	Std. Error of the Estimate	.523

It can be inferred from Table 3 that value of R Square is 0.620 showing that 62% of the changes in the dependent variable "Development of Mushroom Farming as Entrepreneurial Option" can be attributed to

It can be inferred from Table 4 significance level in less than 0.05 (>0.000) stating that null hypothesis of the

present research can be ignored. Thus, it can be stated that there is a significantimpact of Government initiatives on development of Mushroom farming as an entrepreneurship option in Jammu and Kashmir. Further a small F-value (24.475) indicates that the primary data collected in the present research fits the alternate hypothesis.

Table 4: ANOVA Table for Regression Analysis

ANOVA[a]						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	80.422	12	6.702	24.475	.000[b]
	Residual	49.288	180	.274		
	Total	129.710	192			
a. Dependent Variable: Development of Mushroom Farming as Entrepreneurial Option						

Table 5: Coefficient table for Regression Analysis

Coefficients[a]						
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	.189	.180		1.051	.295
	Subsidy provided by Government on mushroom farming	-.029	.062	-.029	-.462	.645
	Financial assistance of Government	.281	.068	.274	4.139	.000
	Training programs run by Government	.051	.052	.062	.973	.332
	Tax exemption schemes of Government	-.178	.073	-.178	-2.448	.015
	Incentives being provided by government like battery-operated spray pumps, polybags, quality spawn and chemicals	.173	.067	.176	2.586	.010
	Introduction of new varieties of high commercial importance in mushroom farming by Government	-.072	.054	-.085	-1.342	.181
	Seed Capital Fund Scheme (SCFS) of Government	.151	.056	.161	2.685	.008
	Youth Start up Loan Scheme (YSLS) of Government	.255	.053	.293	4.796	.000
	Himayat initiative of Government	.072	.063	.075	1.146	.253
	National Minorities Development & Finance Corporation (NMDFC) of Government	.043	.063	.044	.682	.496
	Tie ups of JKEDI with various other renowned institutes in the country promoting entrepreneurship	.149	.068	.148	2.199	.029

	Initiative of Government of India to double the income of Farmers by 2022	.052	.067	.052	.776	.439

It can be inferred from Table 5 that out of all the factors of government initiatives considered inthe present regression model that contributes to growth of Mushroom farming as entrepreneurial option in Jammu and Kashmir, Financial assistance of Government (0.000), Tax exemption schemes of Government (0.015), Incentives being provided by government like battery-operated spray pumps, polybags, quality spawn and chemicals (0.010), Seed Capital Fund Scheme (SCFS)of Government (0.008), YSLS Scheme (0.000) and Tie ups of JKEDI with various otherrenowned institutes in the country promoting entrepreneurship (0.029) were found to be statistically significant while all others are statistically insignificant. Further, Financial assistanceof Government and YSLS Scheme were found to be highly significance with significance value of 0.000. The value of unstandardized coefficient of "Financial assistance of Government" was found to hold the highest value (compared to other significant factors) that is 0.281 thereby suggesting that if 1 unit change takes place in this factor, it will cause 0,281-unit changes in the dependent variable that is in development of Mushroom farming as entrepreneurial option in Jammu and Kashmir. Previous researches conducted in this domain also support this finding thatfinancial support leads to development of entrepreneurship [14-16]. In the same direction, in a research conducted by Chowdhury, it was found that lack of financial support from the government and other institutions lead to reduction in growth of entrepreneurship. Thus, all theseprior researches are in sync with the findings of the present research [17].

V. Conclusion

The present research was focused on assessing the impact of government initiative on the development of entrepreneurship in Jammu and Kashmir taking Mushroom farming as the sectorof interest. The study found a significant impact of Government initiatives on development of Mushroom farming as an entrepreneurship option in Jammu and Kashmir. Further, it was found that financial assistance by the government s the factor that contributes most towards the development of entrepreneurship in Mushroom farming in the region. Further, YSLS Scheme was found to be second most influential factor leading to development of entrepreneurship in Mushroom farming owing to which it can be stated that the government assistance to the youth has a huge potential and contribution in developing entrepreneurship in Mushroom farming in the Jammu Kashmir. This also points towards the fact that assistance to youth and overall financial assistance can further speed up the process of entrepreneurship in Mushroom farming in Jammu and Kashmir apart from other factors.

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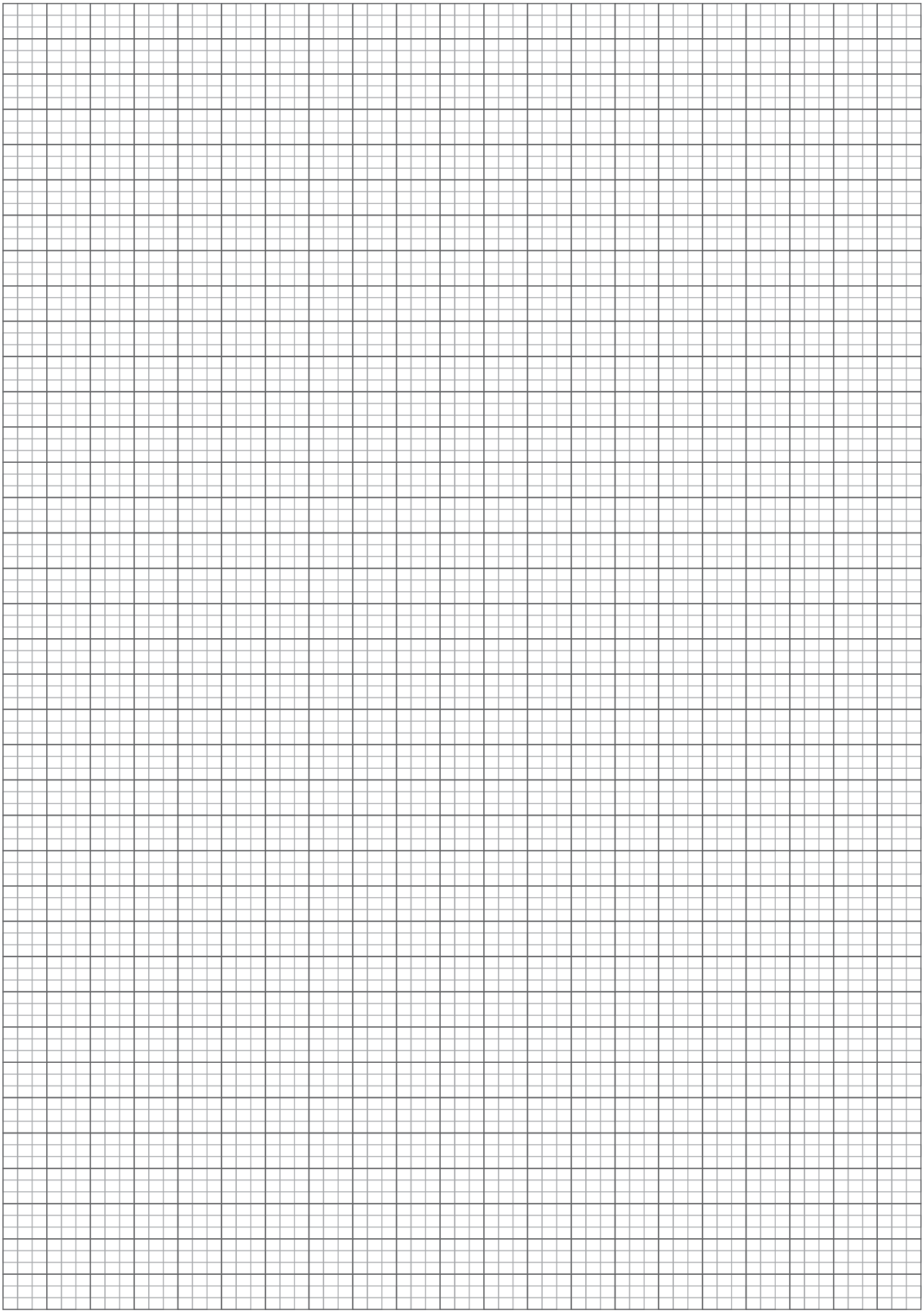

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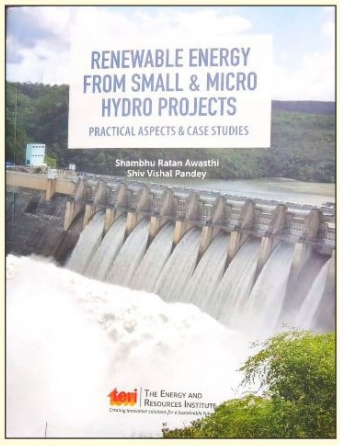

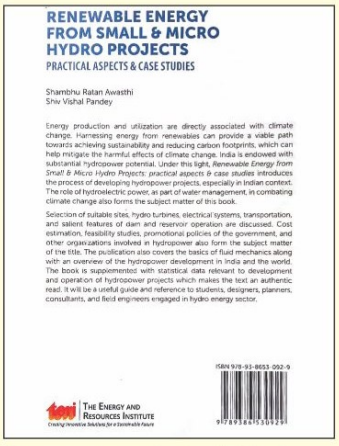

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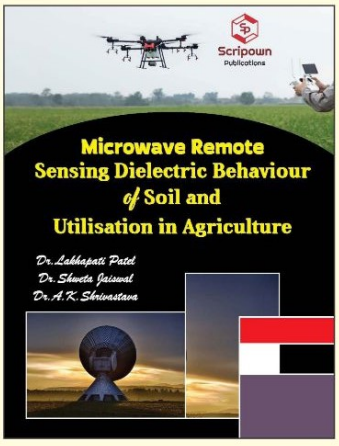

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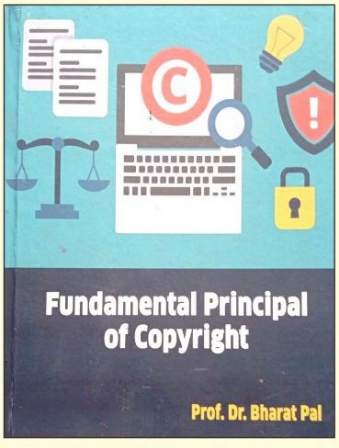

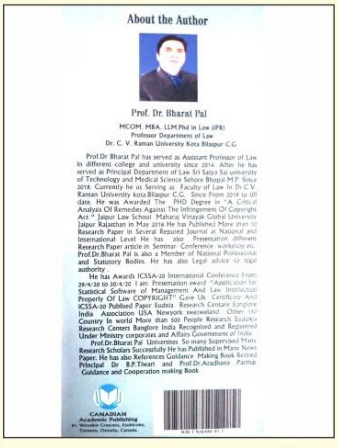

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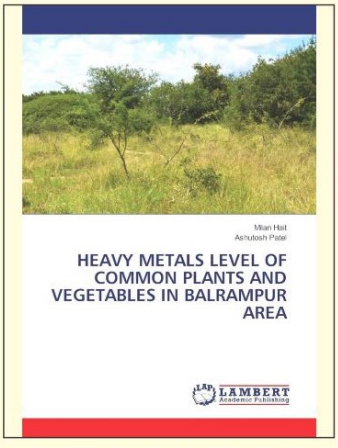

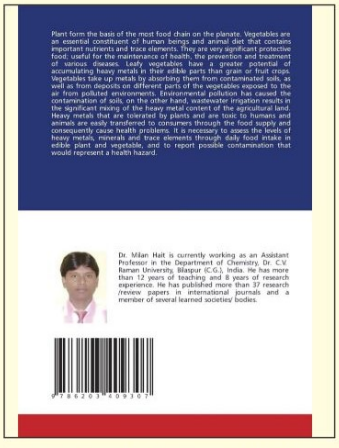

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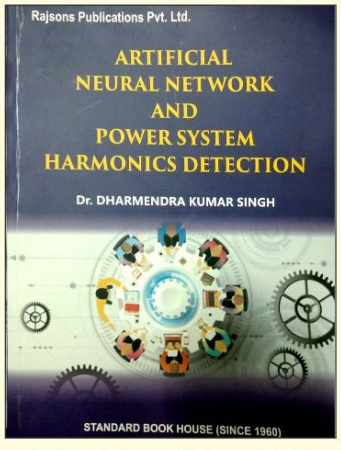

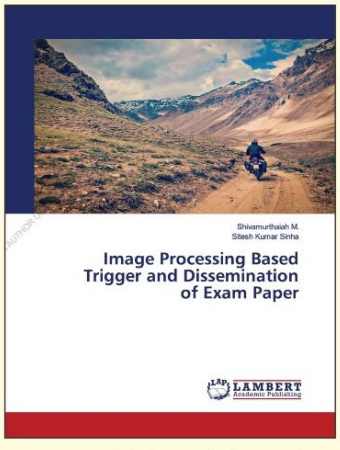

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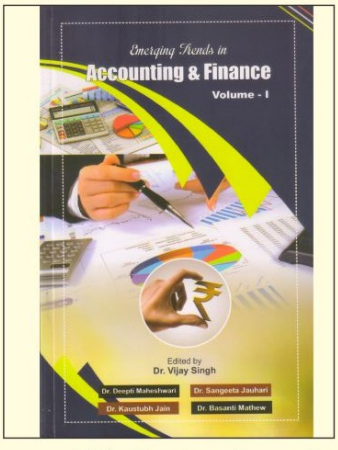

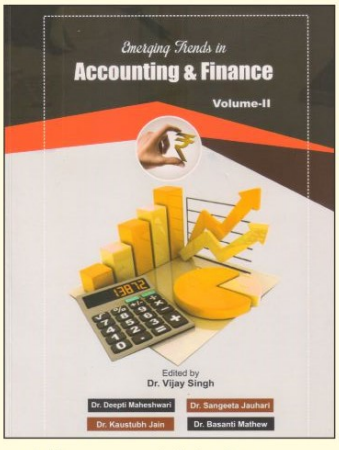

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