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INSIDE

MESSAGE

Research and Innovation Park

What was mooted in 2011 is finally a reality – ready to welcome the corporates and start-ups from Feb. 1, 2022. Yes, the Research and Innovation Park (R&I Park) at IIT Delhi was conceived by the undersigned more than a decade back. Thankfully the initial support by a few faculty colleagues at the Institute strengthened the belief that the Institute should go beyond the incubators which had been initiated in 1999 – amongst the first by a higher technical education institution in India. The Science / Research Parks are a common feature with the top grade universities – Cambridge, Oxford, Hsinchu, Stanford, Maryland, MIT, Utah, etc. in the developed world. Interestingly, IIT Madras has led the way in India. These parks provide a highly facilitative environment for industry to work in close cooperation with academia and research establishments. The cluster of start-ups, large industry players, and research entities create a vibrant ecosystem that enables, inter alia, technology development, knowledge sharing, innovations, and techno-entrepreneurship. For several years now it has been a common sight to see marquee industry names associated with such University Research Park facilities.

The Research and Innovation Park at IIT Delhi was initially started as a mini-Science Park in the backdrop of the Institute's game plan of having three research parks at its three campuses with the other two intended to be larger programs. Creating and sustaining such research park programs in a conservative or uninitiated academic system is a challenge as it has to harmonize with a larger set of internal stakeholders. To reiterate, the R&I Park at IIT Delhi is a reality thanks to strong support received from the Institute management and Govt. of India's Education Ministry (earlier MHRD). Besides, the strategic partners like DST/BIRAC and the all-weather FITT intend to make the R&I Park a flagship program for regional economic development. To harness the knowledge powerhouse that is IIT Delhi, it's time for big R&D tie-ups, intellectual property-driven ventures, and innovators to create value leveraging the Research Park.

Dr Anil Wali

Plant Based Meat Analogues-Future of Clean Proteins for Food

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Over the last few decades, the meat industry has been strengthening continuously due to the massive increase in production of various companies. However, due to the change in consumer behavior, ethical concerns, veganism, rising awareness, and environmental concerns, the companies are shifting towards the development of mock meat.

Consumption of meat products also led to the emergence of various chronic diseases such as cardiovascular disease, blood pressure, diabetes, obesity. These diseases occur due to the presence of cholesterol as well as saturated fatty acids in meat and due to the switching of consumers from a traditional to a more processed and industrialized diet (Boukid, 2021). For instance, meat products such as chicken are related to the disorder due to Salmonella and, fish causes the threat of mercury. A meat-based diet also utilizes a huge amount of environmental resources such as land, water. About 2-15kg of plant foods is required for the production of only 1kg of meat. Animal production also utilizes dozen times more land, water, and fossil fuel usage when compared to the production of plant proteins (Joshi & Kumar, 2016).

Thus, the present meat-dependent diet for protein assimilation in the body is not sustainable from a health, environmental, and food security point of view. One of the effective solutions for this challenging situation is to shift towards a flexitarian dietary lifestyle. It involves reducing animal food consumption and increasing plant-based foods rich in protein such as fruits, vegetables, grains, nuts, oilseeds, and legumes. This opens new vistas for alternate sources of protein like mock meat (Estell & Hughes, 2021). The detailed description of shifting from animal proteins towards plant proteins is illustrated in Fig. 1. mentioned below.

There are different available mock meat such as plant-based, cultured meat, insect-based, microalgae-based and mycoprotein-based mock meat as shown in Fig. 2 (Sha & Xiong, 2020).

Fig. 2. Classification of mock meat

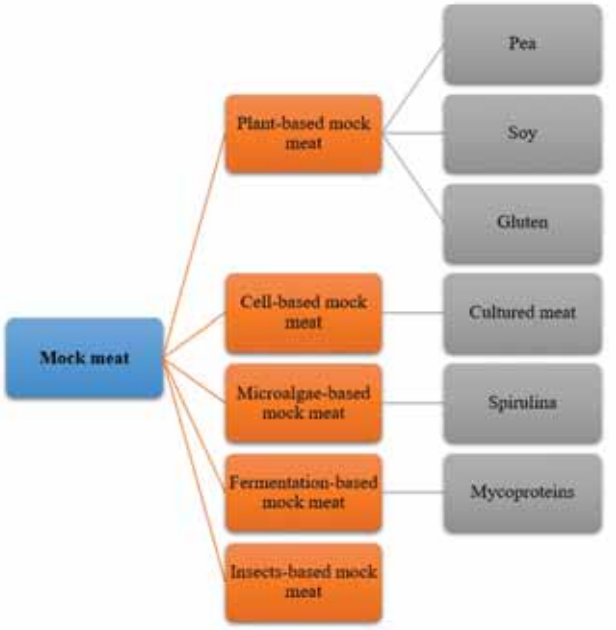
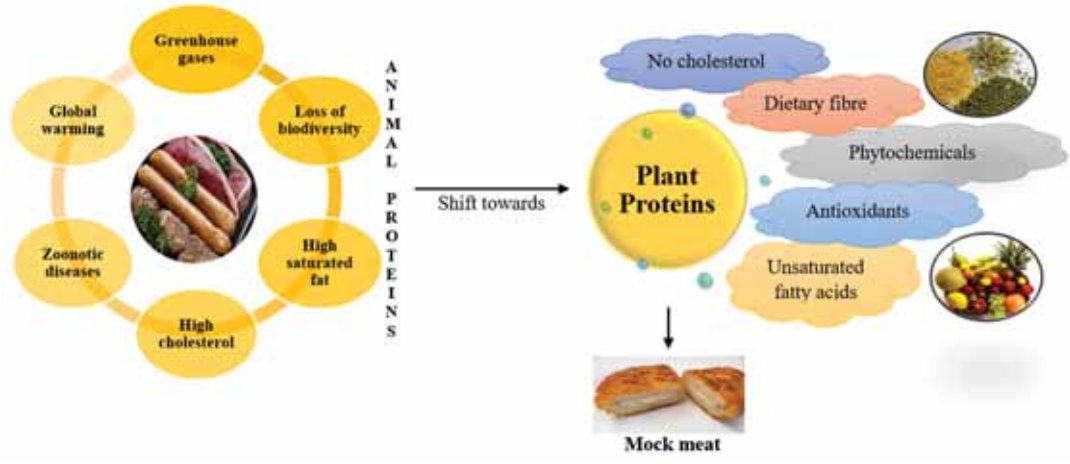


Fig. 1. Importance of plant proteins over animal proteins



Plant-based mock meat can also be termed as faux meat, meat substitute, meat alternatives, imitation meat, or meat analogues. These are plant-based products that are structurally similar to the meat but their composition is different. The plant-based meat market was predicted to be at USD 4.98 billion in 2020 and is estimated to reach from USD 5.37 billion in 2021 to USD 10.80 billion by 2028. Mock meat looks like meat, cooks like meat, and taste like meat but is more nutritious and sustainable than meat products. Mock meat possesses several advantages over meat products as they are cheaper, less hampered by seasonal fluctuations, longer shelf life, and ease in handling (Kumar et al., 2017).

Tofu, tempeh, and seitan are plant-based mock meat that has been utilized in Buddhist and vegetarian meals since prehistoric times in places like India and China. The tofu was first found in other Asian nations such as Japan, Thailand, and Vietnam, and has been manufactured in China for over 2000 years. Tempeh (made from soybeans in Indonesia) and seitan (made from wheat gluten) appeared in China during the sixth century. Although tofu, tempeh, and seitan were used as meat substitutes, there was a lower demand for them. As a result, the first generation of plant-based mock meat, such as TVP, emerged (Texturized Vegetable Protein). Using extrusion technology, TVP was created by combining edible vegetable protein with minimum additives or chemicals. Traditional plant-based meat substitutes, as well as TVP, do not, however, replicate the organoleptic qualities of meat. This lead to the emergence of a new generation of plant-based mock meat in recent years by using technologies such as extrusion. The new-generation plant-based mock meat was developed such as burger patties, bacon, sausage, and hotdogs, to exactly mimic the taste, flavor, color, appearance, and nutritional composition to that of original meat products (He et al., 2020).

India is a remarkable country that constitutes around 55% of the population being vegetarian and constitutes the second-largest land for agricultural production. The diverse agricultural landscape in India offers a wide range of crop groups like cereals, millets, pseudocereals, pulses, fruits, and vegetables. This allows utilizing the resources and crops of India, especially in the development of mock meat to suppress hunger, poverty, and malnutrition.

In the pandemic situation, protein requirement is at its all-time high for immunity resistance and recovery from the infection. The need for sustainable plant-based mock meat started to arise due to environmental concerns, nutritional aspects, ethical concerns, and animal welfare issues. The COVID-19 pandemic is a reminder to suppress zoonotic diseases, which can also relate to the sanitary conditions of animal farming. COVID-19 pandemic also delivers serious concerns over the increased rate of the malnourished and immuno-compromised population due to deficiency of protein-rich foods. With the decrease in market demand, the present situation offers a new way of protein consumption through plant-based protein sources which can be consumed as meat alternatives. Crops like pulses and millets are offering a novel approach as they provide a low ecological footprint in contrast to their animal counterpart.

IIT Delhi is fast becoming a pioneer in research and Development of plant based proteins being worked at Agri-nano Tech Lab. As a part of research, several plant based sources of proteins which are having similar properties to animal proteins have been identified and the meat analogues are being developed for consumption as innovative mock egg targeting towards fulfilling the dietary requirements of vegan, vegetarian as well as health-conscious consumers. The mock egg looks like egg, tastes like egg and provide the same nutritional profile to that of poultry egg and has been rigorously subjected to sensorial acceptability, nutritional profile and consumer preference. We have received first prize at Innovate4SDG contest by 'UNDP (United Nation Development Program) Accelerator Lab India' for the development of innovative mock egg. Following this, other plant based meat analogues to mimic white meat, red meat and sea food segment is also being worked out. The aim is to screen and characterize the plant sources and develop the formulation which can provide the same mouthfeel, texture, functional and nutritional characteristics to that of meat. The technology development also focuses on safe and cleaner product without addition of strong preservatives and additives. The idea also supports to explore the underutilized crops, landraces and local production techniques supporting environment, circular economy and local livelihood.

In conclusion, mock meat is economical, functional, and nutritional which is better for the environment and human population as it does not involve the killing of animals. It consists of more fibre, protein, less fat, no cholesterol, and lower cost. It can help in protecting against heart disease, increasing bone mass, decreasing cancer, and lowering blood cholesterol. Furthermore, food groups extracted from plants possess organoleptic and bioactive constituents which make them a suitable option for deriving clean proteins in an eco-friendly manner. Focusing on the longstanding battle for health concerns, environmental concerns, malnutrition, and ethical issues we are developing a low cost technology for the development of mock meat. We are focusing to develop the low-cost finished product in such a way that leads to providing unique environmental health benefits and available to all segments among the consumers.

References:

1. Boukid, F. (2021). Plant-based meat analogues: from niche to mainstream. European Food Research and Technology, 247(2), 297–308. https://doi.org/10.1007/s00217-020-03630-9
2. Estell, M., & Hughes, J. (2021). Plant Protein and Plant-Based Meat Alternatives : Consumer and Nutrition Professional Attitudes and Perceptions.
3. He, J., Evans, N. M., Liu, H., & Shao, S. (2020). A review of research on plant-based meat alternatives: Driving forces, history, manufacturing, and consumer attitudes.
4. Comprehensive Reviews in Food Science and Food Safety, 19(5), 2639–2656. https://doi.org/10.1111/1541-4337.12610
5. Joshi, V. K., & Kumar, S. (2016). Meat Analogues : Plant based alternatives to meat products- A review. 5(2), 107–119.
6. Kumar, P., Chatli, M. K., Mehta, N., Singh, P., Malav, O. P., & Verma, A. K. (2017). Meat analogues: Health promising sustainable meat substitutes. Critical Reviews in Food Science and Nutrition, 57(5), 923–932. https://doi.org/10.1080/10408398.2014.939739
7. Sha, L., & Xiong, Y. L. (2020). Plant protein-based alternatives of reconstructed meat: Science, technology, and challenges. Trends in Food Science and Technology, 102(May), 51–61. https://doi.org/10.1016/j.tifs.2020.05.022

Designing Institutions for Integrating Renewables in Developing Countries

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Many developing countries are ambitiously investing in intermittent renewable electricity but face problems of integration, partly due to incompatible institutions. However, scaling up intermittent renewables beyond 30-50% (depending on the system) is challenging, as balancing the intermittently generated electricity across space or time becomes necessary. Institutional arrangements can help manage this intermittency to some extent, however, such rules are often absent in developing country energy systems. Institutional challenges in China (Davidson 2018; Newbery 2016) and India (Tongia, Harish, and Walawalkar 2018), for instance, present significant barriers to the integration of renewable electricity. In India, close to 90% of all power is traded through long-term contracts largely with power plants located within a state(CERC 2018), foreclosing options to manage intermittency of electricity supply across space (Das et al. 2020).

Flexibility, the extent to which a power system can modify electricity production or consumption in response to variability, is considered an important feature of electricity systems to incorporate renewable electricity(Verzijlbergh et al. 2017). According to many scholars, some elements of the standard, text-book model of power sector reform can help to incentivize flexibility from market players, in a high-renewable-electricity environment (Ela et al. 2014; Hogan, Weston, and Gottstein 2015; Borggrefe and Neuhoff 2011; Newbery et al. 2018). These elements mainly include vertical unbundling, competitive markets (between generation and retail segments), and most importantly, temporally and spatially granular price signals. Although scholars advocate restructuring primarily to improve efficiency of long-term resource allocation, in high renewable energy systems such allocative efficiency improvements are expected to come from appropriately signalling for (and incentivizing) flexibility services.

However, in partially liberalized electricity markets of developing countries, spot-markets for electricity seldom exist, price signals are weak and large segments of the sector are still regulated and state-owned. Notably, the above elements of the standard model are the least implemented in developing countries which have restructured their power sectors: only 38% have unbundled, while 28% have implemented wholesale markets, and only 8.4% have implemented retail competition. Examples of complete implementation of the standard model exist mainly in the developed world.

This article presents 'design considerations', framed in terms of desired futures and possible constraints, for integrating renewable electricity in those contexts, based on recently published findings (Iychettira 2021). These considerations help identify the extent to which (or conditions under which) specific reforms informed by the neo-classical theory based 'standard model' can be implemented in diverse developing country contexts to integrate renewables. The design considerations are based on the following premises. Firstly, that cost recovery is remarkably difficult to sustain[1]. Although the original standard model posited that cost-recovery from consumers is crucial for utility performance, recent evidence from developing countries questions that claim. Secondly, given pervasive poverty and inequality, distributive pressures are compelled to also be handled through the electricity sector. Three design considerations are structured in terms of the elements of the standard model relevant to renewable integration and least adopted by developing countries: unbundling, wholesale markets or economic dispatch, and principles of retail tariff design; and one design consideration is related to attracting sufficient investment, a problem present in both developing and developed countries.

1. Resolving cost recovery and distributional pressures in a transparent manner are important factors affecting further vertical unbundling of the electricity sector to enable renewable integration.

Only 38% of the developing world had unbundled their vertically integrated power sectors in 2013. Rising shares of renewables strengthen the case not just for vertical unbundling, but also for horizontal integration of transmission networks and system operation, as unbiased use of the network enables system flexibility. Vertical unbundling has been challenging, particularly for developing economies due to several reasons. Firstly, since the primary reason for reform was to attract private capacity, unbundling remained less important, while IPPs became popular. Secondly, since cost recovery and distributive pressures are still major concerns for developing countries(Foster and Rana 2020), it is unlikely that the role of the state in regulating the retail operations of the sector will weaken unless the willingness or capacity to pay improves. Additionally, significant generation capacities remain state-owned too in hybrid markets. In order to avoid incentives for vertically integrated operation in such cases, it is critical to ensure management of these cost recovery and distributional issues in a manner that keeps commercial operations of the retail segment separate from the political and social goals.

2. Issues of cost recovery need to be credibly resolved through public finance management and political mechanisms to enable wholesale spot market operations (or cost-based dispatch mechanisms) and consequent integration of renewables

Only 29% of all developing countries had implemented wholesale spot markets by 2013. However, in the absence of a wholesale market, physical contracts lock-in portions of dispatch before real-time conditions of the grid are known; the longer dispatch is decided before real time, the greater the likelihood of curtailment of renewable electricity generation, and increased overall supply costs. Day-ahead or real-time wholesale markets provide a means of dealing with such contestations by providing signals for the value of producing electricity at a certain time and location. However, examples from both India and China indicate that insufficient cost recovery at the retail level has a direct impact on wholesale market operations or economic dispatch mechanisms, due to lack of working capital required

[1]Any progress made owes more to efficiency improvements (improved utility governance) than to tariff hikes(Foster and Rana 2020).

to participate in such real-time transactions. In situations where state support is required to ensure cost recovery, public finance mechanisms which can help companies trade close to real-time trade are essential to integrating renewables.

3. Impact of distributive pressures on retail tariff design principles in a high-renewable-electricity system need to be balanced against potential demand response needs.

Passing through price signals to the consumer is expected to elicit demand response: a strategy which envisions the consumer changing their demand to reflect the economic value of electricity, which further helps manage the intermittency of renewable electricity(Koliou et al. 2014). As shares of renewables increase beyond, say, 35 to 40% of total consumption, demand response measures can play an important role in providing flexibility. However, so long as poverty and inequality are important considerations, effecting negative consequences on the poor (through true costs) need to be balanced against 'sending the right economic signals'. At the same time, delinking market signals to the able and willing consumers can sharply reduce the space and impetus for demand response measures[2]. Therefore, tariff design theories and practise should address the need to resolve such decisions, i.e., a means to better target subsidies while exposing other consumers to market signals, in an open, fair and transparent manner.

4. Guiding investment for generation capacity in a high renewable, developing country energy system, will require institutions which reflect marginal costs, while hedging investment risks.

In a high renewable system, although short term transparent market signals are critical to indicate where investments for new generation capacity (firm or otherwise) may be necessary, relying on an energy-only market is unlikely to ensure sufficient remuneration for new investments. In developing countries, an added, crucial dimension is insufficient cost recovery from final consumers. Cost recovery issues discourage private investment in generation, without credible promises from the government and a credible independent regulator or legal system to keep the system solvent. Financial contracts (which do not induce out-of-merit-order dispatch), should be employed so that investment risks can be hedged in the least-distortionary manner possible, by separating financial contracts (or power purchase agreements) from incentives for physical dispatch.

The outcomes of this research, i.e., the relevance of cost-recovery issues, distributional imperatives, and governance are particularly salient to future studies which provide market design prescriptions to integrate renewables in developing countries. It provides further evidence of the limited applicability of equilibrium-based modelling studies on developing countries which assume away cost-recovery issues in their prescriptions to change market-design.

References:

1. Borggrefe, Frieder, and Karsten Neuhoff
   2011Balancing and Intraday Market Design: Options for Wind Integration. Discussion Paper. DIW Berlin.
2. CERC
   2018 Report on Short-Term Power Market in India: 2017-18. New Delhi: Economics Division Central Electricity Regulatory Commission. http://www.cercind.gov.in/2018/MMC/AR18.pdf, accessed April 23, 2019.
3. Das, Partha, Parul Mathuria, Rohit Bhakar, et al.
   2020 Flexibility Requirement for Large-Scale Renewable Energy Integration in Indian Power System: Technology, Policy and Modeling Options. Energy Strategy Reviews 29: 100482.
4. Davidson, Michael
   2018 Creating Markets for Wind Electricity in China: Case Studies in Energy Policy and Regulation. Massachusetts Institute of Technology.
5. Ela, E, M Milligan, A Bloom, et al.
   2014 Evolution of Wholesale Electricity Market Design with Increasing Levels of Renewable Generation. Denver, Colorado, USA: National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy14osti/61765.pdf.
6. Foster, Vivien, and Anshul Rana
   2020 Rethinking Power Sector Reform in the Developing World. Washington, DC: World Bank. https://openknowledge.worldbank.org/handle/10986/32335, accessed September 8, 2020.
7. Hogan, Michael, F Weston, and M Gottstein
   2015 Power Market Operations and System Reliability in the Transition to a Low-Carbon Power System: A Contribution to the Market Design Debate. Brussels, Belgium: Regulatory Assistance Project. http://www.raponline.org/wp-content/uploads/2016/05/rap-eumarketdesign-2015-may-5.pdf.
8. Iychettira, Kaveri K.
   2021 Lessons for Renewable Integration in Developing Countries: The Importance of Cost Recovery and Distributional Justice. Energy Research & Social Science 77: 102069.
9. Koliou, Elta, Cherrelle Eid, José Pablo Chaves-Ávila, and Rudi A. Hakvoort
   2014 Demand Response in Liberalized Electricity Markets: Analysis of Aggregated Load Participation in the German Balancing Mechanism. Energy 71: 245–254.
10. Newbery, David M.
    2016 Towards a Green Energy Economy? The EU Energy Union's Transition to a Low-Carbon Zero Subsidy Electricity System – Lessons from the UK's Electricity Market Reform. Applied Energy 179: 1321–1330.
11. Newbery, David, Michael G. Pollitt, Robert A. Ritz, and Wadim Strielkowski
    2018 Market Design for a High-Renewables European Electricity System. Renewable and Sustainable Energy Reviews 91: 695–707.
12. Reporter, Staff
    2019 Bescom Maps out Summer Plan for Smooth Supply. The Hindu, January 23. https://www.thehindu.com/news/cities/bangalore/bescom-maps-out-summer-plan-for-smooth-supply/article26072148.ece, accessed January 24, 2021.
13. Tongia, Rahul, Santosh M. Harish, and Rahul Walawalkar
    2018 Complexities of Integrating Renewable Energy into India's Grid. New Delhi: Brookings India. https://www.brookings.edu/research/complexities-of-integrating-renewable-energy-into-indias-grid/, accessed March 18, 2020.
14. Verzijlbergh, R.A., L.J. De Vries, G.P.J. Dijkema, and P.M. Herder
    2017 Institutional Challenges Caused by the Integration of Renewable Energy Sources in the European Electricity Sector. Renewable and Sustainable Energy Reviews 75: 660–667.

[2] At the same time, experience in India indicates that granular price signals may not always be a necessary guide to load shifting; at relatively low shares of intermittent RE, heuristics may suffice to regulate and shift some relatively elastic loads. For instance, supply companies in the state of Karnataka ensured that agricultural loads were served electricity in a manner approximately consistent with solar generation patterns(Reporter 2019).

Decarbonised Energy Efficient Healthy Indoor Environment: A Holistic Approach

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Introduction & Motivation

While reading this article, sitting in your room, imagine how would you feel if you are exposed to extreme heat or cold? Would you be able to read this or do any other chore, if the lighting is not adequate? Or for that matter, if excessive lighting is flashing in your eyes? What if O2 levels start decreasing in your room, or CO2 levels start increasing? Would you feel comfortable in a stale air environment, containing pathogens and toxic gases? The answer to all these questions is 'You would definitely not feel comfortable!' Temporary exposure to such conditions would affect the health, well-being, and productivity of the occupants, however, prolonged exposure can lead to critical, life-threatening health issues. With the outbreak of COVID-19, the issue of having a comfortable and safe environment has been gaining much attention to cater to the current situation as well as any unforeseen airborne infections (Figure 1). All these parameters form a part of the indoor environmental quality (IEQ) of a building.

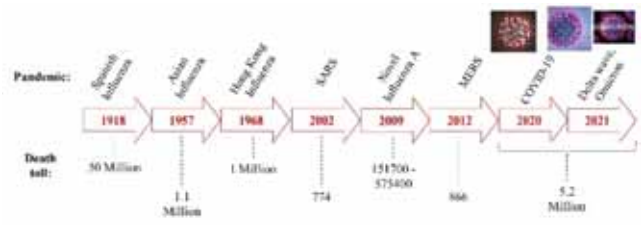


Figure 1: Global history of pandemics

The immediate response to tackle this would be to look for ways to bring all these parameters to a comfortable level, and our team does exactly that! This would, however, require huge amounts of energy and resources, leading to higher cost implications and harmful environmental impacts. The main aim of our team is thus to design and develop healthy, safe, and comfortable building systems incorporating passive techniques as far as possible (that utilize natural energy opportunities, such as solar, wind, etc.), and employing efficient active strategies (that use/produce electricity for tending to the requirements of occupants). This not only leads to achieving energy conservation and energy efficiency in buildings, but also leads to reduced carbon footprint and more monetary savings – a 'win-win' situation holistically!

Associated Studies Conducted

The present COVID-19 situation has highlighted the critical importance of global infrastructure development for human survival. Furthermore, controlling base airflow is the safest initial preventive action for dealing with any unforeseen airborne pathogen with unknown infectious particle size. To accommodate a large, infected population, copious wards must be constructed within the existing constraints of land, power, and material availability.

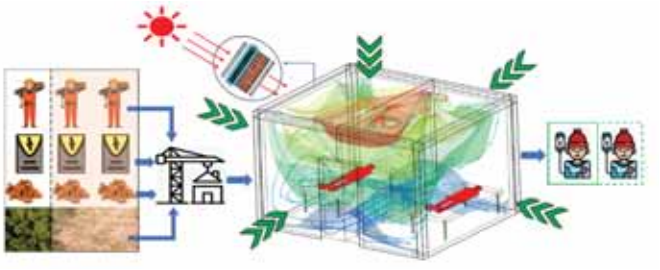


Figure 2: Design of an energy efficient health ward

The study [1], featured in Elsevier Public Health Emergency Collection (Public Health Emergency COVID-19 Initiative) and PubMed Central® (PMC) [2], involved designing a two-bed modular healthcare ward, shrunk in size to minimize the requirement of space and other construction commodities such as materials, labour and power (Figure 2). HVAC energy usage was also considered for conservation. The health safety and thermal comfort of occupants were regulated by monitoring indoor environment attributes while striving for a resource-efficient structure. Two popular envelope thermal retrofits viz. phase change material (PCM) and thermal insulation were tested to determine gains in terms of improved energy performance of the ward. In the multicriteria decision making process, various ward designs contested with their energy performance and occupant's health safety and comfort characteristics to deliver the most favourable solution. As a result, a design involving thermal insulation retrofit with an 8 ACH fresh air supply rate and a 26 °C inlet air temperature provided the most appropriate solution.

PCM in the above study was used based on the prior studies done by the team on designing a system that could result in lowering the peak inside temperatures, triggering the idea of using high heat storage capacity materials within building elements, such as bricks (Figure 3). Selected PCMs based on climatic conditions (thermal mapping) were then characterized and macro encapsulated in the bricks to assess their thermal and mechanical behavior. For Delhi (composite climate) in particular, PCMs OM35 and n-Eicosane were found suitable based on their characteristic charging and discharging through DSC. It was found that inside temperature reductions were around 6 °C for single PCM and 10 °C for dual PCM layered brick during peak hours of the day with respect to conventional bricks [3]. Subsequent avenues to probe the thermal performance of the PCM incorporated bricks were explored by mixing the PCMs with nanoparticles. However, for building applications the nano enhanced PCM did not exhibit any promising results. The study has resulted in a whitepaper as well.

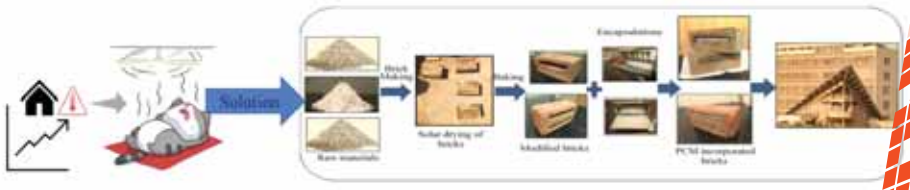


Figure 3: Thermal load abatement utilizing PCM incorporated bricks

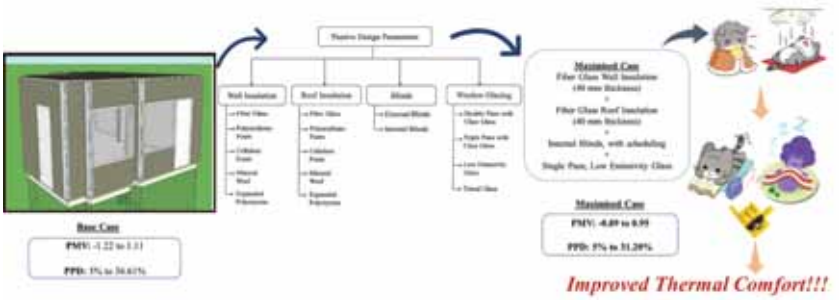


Figure 4: PMV and PPD based maximisation of thermal comfort utilizing different passive strategies

Apart from PCMs, several other passive strategies (Figure 4), were analyzed for an office room in Delhi based on thermal comfort indices (PMV and PPD). The ideal PMV range is -0.5 to 0.5 and PPD ≤20%. Existing comfort conditions were obtained using experimental readings, whereas maximised comfort conditions were obtained by finding optimal combination of strategies using simulation, resulting in ~14%–27% improvements [4].

Another simulation study conducted to find out the thermal comfort and energy-saving potential of various coupled passive strategies in the workshop building of Department of Energy Science and Engineering, IIT Delhi, involved analyzing the energy percentage savings for three locations lying in the same climatic zone (Figure 5). For the summers, a cool roof, either standalone (18% energy savings) or combined with other passive design strategies such as PCM, insulation, and shading, provide the best indoor temperatures. Energy Performance Index improved by 20.5% using such passive design technologies [5].

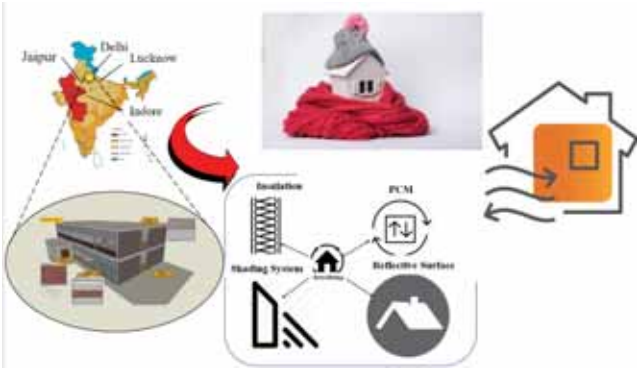
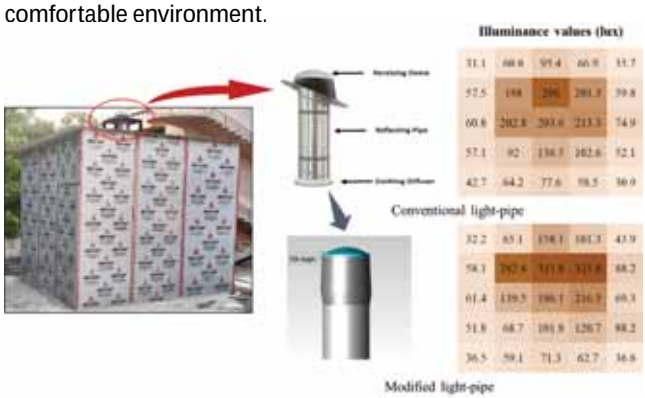


Figure 5: Thermal comfort enhancement and energy saving potential of different passive techniques

Apart from IEQ parameters mentioned above, visual comfort too plays an important role. Hence, studies on daylight utilization for reduced lighting energy consumption to maintain visual comfort have also been conducted by the team. A light-pipe has been installed on a test room constructed on the workshop building of Department of Energy Science and Engineering, IIT Delhi, and its performance has been evaluated [6]. Further, study on structural modification of the light-pipe by making it wider near bottom, was performed to assess the changes in the illuminance values (Figure 6). A 2.14% to 9.84% increase in the efficiency of the light-pipe was observed [7].

Our team is further working on designing optimal net-zero energy buildings with holistic comfort, devising ways to enhance the thermal conditioning of buildings, and determining the most effective ventilation technique for providing a safe and thermally comfortable environment.



Conclusions

Maintaining IEQ while designing energy efficient buildings and its systems is of utmost importance. The proposed design in the studies can assist developing countries in planning a rapid response to pandemic outbreaks while reducing construction (cost, time, and energy loads). The models used in the studies conducted will prove as an effective tool for selecting material while retrofitting buildings with passive design strategies and can be adopted by the Energy Conservation Building Code (ECBC). The methodology could also be adopted by real estate companies for weighing different retrofitting options influencing occupant's thermal comfort conditions. Transfer of technology and mass commercialization could also take place with the interested infrastructure development and construction companies.

References:

[1] P. Saikia, D. Rakshit, R. Narayanaswamy, F. Wang, and Udayraj, "Energy performance and indoor airflow analysis of a healthcare ward designed with resource conservation objectives," J. Build. Eng., vol. 44, p. 103296, 2021, doi: https://doi.org/10.1016/j.jobe.2021.103296.

[2] P. Saikia, D. Rakshit, R. Narayanaswamy, F. Wang, and Udayraj, "Energy performance and indoor airflow analysis of a healthcare ward designed with resource conservation objectives," Elsevier Public Health Emergency Collection, PMC, US National Library of Medicine, National Institutes of Health, 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8438806/.

[3] R. Saxena, D. Rakshit, and S. C. Kaushik, "Experimental assessment of Phase Change Material (PCM) embedded bricks for passive conditioning in buildings," Renew. Energy, vol. 149, pp. 587–599, Apr. 2020, doi: 10.1016/j.renene.2019.12.081.

[4] S. F. Ali, L. Sharma, D. Rakshit, and B. Bhattacharjee, "Influence of Passive Design Parameters on Thermal Comfort of an Office Space in a Building in Delhi," J. Archit. Eng., vol. 26, no. 3, pp. 04020017 1–19, Sep. 2020, doi: 10.1061/(ASCE)AE.1943-5568.0000406.

[5] R. Verma, S. Kumar, and D. Rakshit, "Investigation on Energy Saving Potential and Thermal Comfort Analysis of Building using Passive Strategies under Composite Climatic Conditions in India," Sol. Energy, ASME, 2022. (under review)

[6] A. S. Azad and D. Rakshit, "Energy Conservation and Sustainability Due to Passive Daylight System of Light Pipe in Indian Buildings," in Sustainable Energy Technology and Policies: A Transformational Journey, Springer, Singapore, 2018, pp. 375–400.

[7] L. Sharma, S. F. Ali, and D. Rakshit, "Performance evaluation of a top lighting light-pipe in buildings and estimating energy saving potential," Energy Build., vol. 179, pp. 57–72, Nov. 2018, doi: 10.1016/J.ENBUILD.2018.09.022.

FACULTY PROFILE

Prof. Ashish Kamalakar Darpe
Department of Mechanical Engineering, IIT Delhi

Dr Ashish K Darpe is currently serving as a professor at the Department of Mechanical Engineering at IIT Delhi. Starting his professional education with a Diploma in Mechanical Engineering, he went on to pursue his academic path with a doctoral degree from IIT Delhi in 2002 in the area of Rotor Dynamics. He has 6 years of R&D experience at IIT Delhi while working as a Research Associate and Project Scientist in sponsored research projects funded by Department of Science and Technology, Board of Research in Nuclear Sciences and Bharat Heavy Electricals Limited. With a brief stint at T.U. Dresden in 2003, Dr. Darpe joined as Assistant Professor at IIT Roorkee and later moved to IIT Delhi in 2004. He has been teaching at IIT Delhi for the last 17 years while pursuing his research interests in the area of Vibrations, Rotor Dynamics, Machinery Health Monitoring and Noise Engineering.

He has published over 110 research articles, filed three patents and supervised/co-supervised 12 doctoral students and currently 8 research scholars are pursuing their research under his supervision/co-supervision. He has delivered more than 40 invited/guest lectures at various places including G.E. Bangalore, ISRO Trivandrum, Simulator Development Division of Indian Army, Secunderabad, Crompton and Greaves, Mumbai, etc. in India and abroad such as Wartsila Finland Oy., Finland, VTT Finland, University of Munich, Germany, University of Electronic Science and Technology of China, Chengdu, University of Alberta, and University of Dalhousie, Canada.

His research and development activity spans 14 sponsored R&D projects and over 35 consultancy projects valued more than 12.8 crores. He has completed (as P.I. or Co-P.I.) sponsored research projects funded by various agencies including BARC, DST, Office of the Principal Scientific Adviser to Govt. of India, Naval Science and Technological Laboratories (DRDO), European Union, Aeronautical Research and Development Board, and Indian Space Research Organization (ISRO). He is currently involved with 5 prestigious projects funded from S.E.R.B. (IMPRINT-II), ARDB (D.R.D.O.), ISRO, National High-Speed Rail Corporation, and U.G.C.-German Academic Exchange Service. He has been a consultant to various organizations and industries, including Wartsila Finland Oy., Finland, Powerplate Inc., USA, Delhi Metro Rail Corporation, Triveni Engineering and Industries Ltd., Laser Science and Technological Laboratories (LASTEC, DRDO), Naval Science and Technological Laboratories (NSTL), Simulator Development Division (Indian Army), Principal Director of Commercial Audit, Comptroller and Auditor General of India, New Delhi., NBC Bearings, GMR (Delhi International Airport Pvt. Ltd.), Imerys Graphite and Carbon, Switzerland, etc. He has been a guest scientist at the Institute of Lightweight Structures, TU, Dresden, Germany (May-July, 2003), visiting researcher at Knowledge Centre of Smart Machines, VTT Technical Research Centre of Finland, (May-July, 2009) and Guest Scientist at Cluster of Excellence "ECEMP – European Centre for Emerging Materials and Processes Dresden", TU, Dresden, Germany (May-July, 2013) and visiting faculty at the University of Alberta, Edmonton, Canada (June-July 2019). He is one of the founder Directors of a start-up Silverknight Technologies Pvt. Ltd. at IIT Delhi.

Prof. Darpe specializes in the domain of vibration and rotor dynamics. Working in a multi-institution project team in the development of an online diagnostic system for the condition monitoring of a turbogenerator set of an atomic power plant in the late 90s, set the tone for the industry relevant and practical R&D work. His research team at the Vibration Research Laboratory is involved in developing technologies for the diagnosis and prognosis of machine elements, in particular of gears and bearings, among others. Among the key outcome of his research has been the reliable fault diagnostics of rotor faults such as fatigue crack, shaft/coupling misalignment and contact rub. The research challenge addressed was to isolate the faults with apparently similar frequency signature to pinpoint the exact fault through novel signal analysis backed by physics of the system. Later, through an industry collaboration the focus shifted from rotors to other critical machine elements. The research activity did not only stop at doctoral theses or international journal publications, but he ensured that the outcome and learnings through the lab-based experimental and simulation work translates to the development of a system/software, that the industry can use and benefit. Three major projects on condition monitoring and fault diagnosis were completed during the previous decade, bringing many equipment, instruments to the lab and several doctoral students benefited from the rich resource of the lab. The Vibration Research Laboratory also caters to industrial consulting work in the broad areas of noise and vibration. Prof. Darpe ensures that this activity helps students from the lab get exposure to sensors and instrumentation, practical work, planning for the experiments, analysis and simulations, and more importantly he ensures that most of this work gets utilized later in either case-studies to be discussed in relevant courses, or used in lab-based teaching, or tailormade short projects. Work done for Bengal Engineering Industries, Powerplate Inc., DMRC, etc., have already become part of the laboratory exercises in UG/PG courses.

As spin-offs of the R&D work, he has thus far effectively transferred 6 indigenously developed technologies to the industry. This includes a state of the art bearing diagnostic system for real time monitoring of turbopump bearings for the test facility at LPSC, ISRO. These R&D efforts of the team involving research scholars, UG and PG students were specially acknowledged by the then Director of LPSC through an appreciation letter. The outcome of the research activities on bearing diagnostics has resulted in filing of two patents and development of ready to install Multi-Sensor Data Fusion Based Diagnostic & Prognosis System for Machine Tool Spindle Bearings named "Nidaan" with active collaboration with Micromatic Grinding Technologies Ltd., that was integrated to their CBN Grinding Machine and exhibited during IMTEX-2015 exhibition in Bangalore. A tailormade version of this system has been bought by one of the ordnance factories. His team also developed and transferred the technology as a final product to a bearing quality assessment system for a major bearing OEM in Jaipur. The team headed by him developed a rotor dynamic design and analysis software for use in turbopump design of Liquid Fuel RamJet missile for Defense Research Development Laboratory

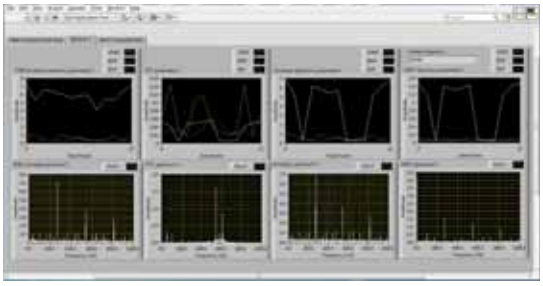
(DRDL), Hyderabad. A similar development work for the analysis of turbopump dynamic behavior for the ISRO is currently in progress. His team was also instrumental in design of an acoustic barrier at the Terminal 3 of the IGI airport. Most industries with whom his team had worked have always come back for the extensional/new work that emphasizes the confidence in the working and abilities of the team at the Vibration Research Laboratory he heads. He has also been collaborating with faculty colleagues from other departments on topics of mutual interests ranging from blast mitigation approaches to brake-squeal issues, in the broad areas of vibration and noise.

Several of his students bagged awards for the industry oriented/ hardware-oriented projects. Notable among them are Padmashri Man Mohan Suri Project award for the best innovative hardware oriented B.Tech. project in Mechanical Engineering (Himanshu Patel and Rahul Mittal, 2016), Suresh Chandra Memorial Award: Best software undergraduate project for B.Tech. Thesis in Mechanical Engineering (Jagatpreet Singh Nir, 2013), Padmashri Man Mohan Suri Project award for the best innovative hardware oriented M.Tech. project in Mechanical Engineering (Ankush Sharma, 2014, in co-supervision). The UG student Suyash Agarwal (2017) received the BOSS award for best hardcore experimental B.Tech. project in Mechanical Engineering for his relentless efforts to realize the innovative idea of developing a smart rolling element bearing (jointly supervised). Prof. Darpe acknowledges contribution from several of his faculty colleagues and feels blessed with and grateful to a group of devoted and motivated UG/PG students and research scholars at the Vibration Research Laboratory.

Prof. Darpe is currently the team leader for a joint IIT Delhi-T.U. Dresden collaborative project funded by UGC-DAAD, and an IMPRINT project on Development of Health and Usage Monitoring System in joint industry collaboration with Larsen & Toubro, where the HUMS is under development for the final drive of a main battle tank. He is also the lead investigator for the development of a prognostic system for aircraft mounted accessory gearbox for ARDB, DRDO and development of a high spin speed rotor dynamic design and transient rotor dynamic code for Indian Space Research Organization. He is also the member of a project team for the development of an indigenous simulation model for OHE-Pantograph interaction dynamics for the National High-Speed Rail Corporation Ltd., India. He has been involved in the organization of 2 reputed international conferences and has conducted 14 short courses/workshops, two of them with Swedish International Development Cooperation Agency and MWL, KTH Stockholm Sweden. He has conducted training programs for scientists/engineers of Kirloskar Ebara Pumps Ltd. Pune, Maruti Suzuki India Ltd. Gurgaon, Delhi Metro Rail Corporation, National High-Speed Rail Corporation Ltd., New Delhi in the areas of Noise and Vibration, Rotor Dynamics, etc., in addition to a TEQUIP short term course on Vibration Analysis of Rotor Bearing Systems.

Bearing Condition Monitoring System integrated with CBN Grinding Machine of MGTL
(in display at IMTEX-2015)

Vibration Analysis Software (LPSC, ISRO)



Advanced Condition Monitoring Bearing Diagnostic Tool for LPSC, ISRO

Bearing Quality Assessment System developed for NBC Bearing (NEI, Jaipur)

Prof. Darpe has been teaching varied courses in the design domain from Graphic Science to the 1st year UG students to the research elective Rotor Dynamics to the senior PG students and consistently getting excellent student feedback. He believes one of the main reasons of it lies in bringing his experience and understanding from the research and development and consulting activities into the teaching of these courses. High quality of students ensures excellent probing questions leading to self-development and improvement, prompting one to raise the bar up every time one teaches the course. In addition, he acknowledges the influence of the teaching philosophies of his mentors during his career and has drawn from the passion of other esteemed colleagues of the institute. He considers the commitment, punctuality and professionalism from one of his teachers that he tried to imbibe, as some of the greatest gifts apart from the knowledge they provided. He strongly believes that the greatest benefit of working in this institute is the company of illustrious and committed academicians with immense wisdom, motivating and inspiring everyone to deliver the best in them.

Prof. Darpe is awarded with J M Mahajan Best Young Teacher Award: Mechanical Engineering, 2010 at IIT Delhi and an Erasmus+ Mobility award in 2020. He has been a Member, Propulsion Panel, Aeronautical Research and Development Board, Defence Research and Development Organization, Govt. of India since April 2011 and Member, Senate, Visvesvaraya National Institute of Technology, Nagpur. He is a Life Member of Condition Monitoring Society of India. He was also a member of the Expert Group on Health and Usage Monitoring Systems (related to Aerospace Systems IVHM), Vaishwik Bharatiya Vaigyanik (VAIBHAV) Summit, Oct 2020. He was also listed among the top 2% scientists in the world in his domain by Stanford University, 2020 and 2021.

The future plan of his research group is to lead the research and development work on robust Health and Usage Monitoring Systems and Integrated Vehicle Health Management systems, Prognostics and Diagnostics, particularly for the aerospace and defense industry, migrating from component specific issues to the holistic system oriented one.

Col. Naveen Gopal (Retd.)
COO, FITT, IIT Delhi

Col Naveen Gopal joins FITT as its Chief Operating Officer. He is an Alumni of IIT Delhi and has done his Master's Degree in "Integrated Electronics and Circuit Design". Being from the technical wing of the defence forces and also having served in the corporate world, he brings a rich and varied experience to the fold of FITT. In his corporate avatar he has worked in the field of Telecommunications and Smart Cities.

As Head of the Asset management vertical in his last organisation; he was actively involved in leading the development and implementation of asset management maintenance strategies, policies and driving product improvements for nearly 1.25 lacs telecom towers spread over 13 states Pan India.

His areas of responsibility included interfacing between the business and IT for leading development of smart solutions. As part of the change management strategy and Business Process reengineering, he led process improvements by developing solutions to improve operational efficiency through asset tracking, reduction in repair TAT for assets and build accountability in the system for non-compliance of scheduled maintenance.

The above activities when required to be implemented Pan India pose their own set of challenges.

He has also served as the Project Director for two major Smart City Projects in two of the biggest states in North India i.e., UP 100 Emergency Response System and Rajasthan Government's ABHAY Police Command & Control Centre. Both Projects were the first of their kind which catered for enabling emergency services for the common citizen of the country.

The technology intensive projects required understanding of both IT hardware and software. The projects required setting up of Data centres across multiple locations, establishing control rooms and Call Centre for monitoring call inflow. For the Control room operations management, multiple applications like the emergency response systems solutions, AI enabled cybercrime applications for video analytics, people search, face recognition etc were deployed. In addition, applications to monitor social media, intelligent traffic management and cyber forensics investigation capabilities were also made live with the overall aim to provide the police force with better insights and help in reducing crime.

In his innings with defence forces which continued for over 25 years, he has rich experience in the field of Information Technology and his last appointment was Head of the Network Support and Maintenance set up at Army Headquarters. His organisation was responsible to provide ITSM and Contract management for Integrated Projects for the complete Army Headquarters. He was awarded the Vice Chief of Army Staff commendation for automating IT asset management IHQ- Ministry of Defence (Army) and achieving over 30% YoY savings on procurement spends.

He has also handled multiple roles and appointments during his innings with the army which vary from software development, to administration, to logistics and supply chain management. He has also served in the inhospitable terrains of North and was awarded the Northern Army Commanders commendation for ensuring a high availability index for the equipment in operations in Kargil/Drass sector.

He is a focused individual with a target oriented approach and we wish to see him succeed in his current role and appointment.

Abbreviations

AM:	Department of Applied Mechanics
BSTTM:	Bharti School of Telecommunication Technology and Management
CARE:	Centre for Applied Research in Electronics
CAS:	Centre for Atmospheric Sciences
CART:	Centre for Automotive Research and Tribology
CBME:	Centre for Biomedical Engineering
CE:	Department of Civil Engineering
CHEME:	Department of Chemical Engineering
CHY:	Department of Chemistry
CRDT:	Centre for Rural Development and Technology
CSE:	Department of Computer Science and Engineering
DBEB:	Department of Biochemical Engineering and Biotechnology
DESE:	Department of Energy Studies and Engineering
DMS:	Department of Management Studies
DMSE:	Department of Material Science & Engineering
DOD:	Department of Design
EE:	Department of Electrical Engineering
HUSS:	Department of Humanities and Social Sciences
KSBS:	Kusuma School of Biological Sciences
MATHS:	Department of Mathematics
ME:	Department of Mechanical Engineering
PHY:	Department of Physics
TFE:	Department of Textile and Fiber Engineering

and many more...

FITTFOOTPRINT

Some IPR Applications filed during July-December, 2021

Sl. No.	TITLE	PI	Centre/ Dept / School
1	A porous catalyst composition and processes thereof	Prof KK Pant	CHEME
2	A method for semi-active vibration control of structures	Prof V Matsagar	CE
3	Cytocompatible and infection-resistant polymeric scaffolds and methods thereof	Prof S Saha	DMSE
4	A system for modulating a brushless DC motor and its method of operation thereof	Prof B Singh	EE
5	Shoulder implant	Prof D Kalyanasundaram	CBME
6	Bimetallic graphitic carbon nitride for photoelectrode and preparation method thereof	Prof AK Bhaskarwar	CHEME
7	A hybrid powered air conditioning system	Prof S Mishra	EE
8	A novel peptidomimetic compound-based inhibition of dialysis related beta-2-microglobulin amyloidosis	Prof TK Choudhuri	KSBS
9	For a turbine based low-cost ventilator/hi-flow nasal cannula	Prof PVM Rao	DOD
10	Method in blockchain systems for fast stabilization increased responsiveness	Prof VJ Reberio	CSE
11	An intelligent supervisory EV charging architecture to enable continuous charging with grid intermittency	Prof B Singh	EE
12	A retrofitted smart energy metering device, method and a system thereof	Prof BK Panigrahi	EE
13	Transglutaminase nanoflowers	Prof SK Khare	CHY
14	A system and method for detecting, tracking and classification of activity of a subject	Prof SK Koul	CARE
15	Gripper to grasp object by internal surface interaction	Prof JP Khatait	ME
16	Eco-friendly and copper free friction materials, brake pads and shoes	Prof J Bijwe	ITMMEC
17	A single-phase grid interactive synchronous reluctance motor driven multipurpose and multifunctional solar water pump	Prof B Singh	EE
18	An automated instrument and microfluidic chip for improved and rapid testing of nucleic acid	Prof SK Jha	CBME
19	Novel PH responsive biodegradable polyesters	Prof J Jacob	DMSE
20	A system for monitoring and control of chromatography	Prof AS Rathore	CHEME
21	Biomass cooking stoves	Prof SK Tyagi	CES
22	Mobile system for processing organic waste matter	Prof VM Chariar	CRDT
23	Reusable sanitary napkin	Prof S Paldas	DOD
24	Reusable panty liner	Prof S Paldas	DOD
25	A hybrid water pumping system	Prof B Singh	EE
26	An apparatus for developing ceramic coating and a method thereof	Prof D Kumar	CART
27	3-D storage medium and method providing thermal management	Prof PR Panda	CSE
28	System and method for making electro-conductive fabric	Prof D Das	TFE

29	A method and system of particle image velocimetry	Prof M R Cholemari	AM
30	Pollution monitoring system and method thereof	Prof S Chatterjee	EE
31	System and method for optimizing data transmission in a communication network	Prof S De	EE
32	A system for optimizing energy transmission and a method thereof	Prof S Chatterjee	EE
33	A wind powered energy generating system and method thereof	Prof B Singh	EE
34	A microgrid control framework for preventing power blackouts	Prof B Singh	EE
35	A method for allocating channels for LDPC codes and a system thereof	Prof A Dixit	EE
36	A photo-bioreactor with closed recirculation of fluid for simultaneous cultivation of photosynthetic micro-organisms and conservation of nutrients and a method thereof	Prof A Malik	CRDT
37	A system for controlling solar PV arrays	Prof B Singh	EE
38	A method and an apparatus for wireless information and energy transfer using distributed beamforming	Prof S De	EE
39	Polymer coated metal particles and synthesis method thereof	Prof K Manna	CHY
40	Dual sensitive polymeric nanoparticles	Prof N Singh	CBME
41	A system for anonymizing camera wearer's identity in an egocentric video and a method thereof	Prof C Arora	CSE
42	Buckling inhibited aluminium shear yielding damper	Prof DR Sahoo	CE
43	A system facilitating health monitoring and a method thereof	Prof VM Chariar	CRDT
44	A method for selecting multi-access edge computing host (MECH) and a system thereof	Prof H Saran	CSE
45	A process for preparation of a biocomposite material	Prof D Das	TFE
46	Three-dimensional storage medium and a method for thermal management based on low power state	Prof PR Panda	CSE
47	A sensorless speed control system for submersible induction motor	Prof B Singh	EE
48	Switched reluctance motor for energy efficient industrial exhaust fan	Prof B Singh	EE
49	A cycloadduct product and a process for its synthesis thereof	Prof RP Singh	CHY
50	Process for developing inoculum and fungal mycelial biomass of calocybe indica	Prof S Sharma	CRDT
51	A wind-solar photovoltaic-battery energy storage based hybrid AC/DC microgrid and an operation thereof	Prof B Singh	EE
52	Single DC source based three phase high resolution multilevel inverter sytem and its method thereof	Prof SK Chattopadhyay	DESE
53	Development of a method for simultaneous reduction of nitrogen oxides and hydrocarbon emissions from an internal combustion engine	Prof D Bhatia	CHEME
54	Resins for application on textiles	Prof AK Agrawal	TFE
55	Framework for quantitative penumbra estimation from SWI-MRI in patients with acute stroke	Prof A Singh	CBME
56	Enhanced brightness solution-processed inorganic ABX3 perovskite leds using a PEG-PVP additive	Prof M Singh	EE
57	Microfluidic analyser for in-vitro biosensing and diagnostics	Prof R Elangovan	DBEB
58	Novel activation function with hardware realization for recurrent neuromorphic networks	Prof M Suri	EE
59	Field-effect transistor device and a method of fabrication thereof	Prof S Das	CARE

TECHNOLOGY PROFILE

RT-PCR-based Assay for Identification of Omicron Variant of SARS-CoV-2 Developed at IIT Delhi

Prof. V Perumal
KSBS, IIT Delhi

Researchers at IIT Delhi's Kusuma School of Biological Sciences have developed an RT-PCR based assay for the specific detection of the Omicron (B.1.1.529.1) variant of SARS-CoV-2.

The assay is based on detecting specific mutations, which are present in the Omicron variant and absent in other currently circulating variants of SARS-CoV-2. Primer sets targeting these unique mutations in the S gene were designed for the specific amplification of either the Omicron variant or other currently circulating variants of SARS-CoV-2 and tested using real time PCR. Using synthetic DNA fragments, the assays were optimised to distinguish the wild-type from the Omicron variant in a dynamic range from 10 million to <100 copies /reaction.

Currently, the identification or screening for omicron is done world-wide using next-generation sequencing based methods, which require over 3 days. By using this RT-PCR based assay, it will be possible to test for the presence of the Omicron variant within 90 minutes.

This can be used as a rapid screening assay for the identification and isolation of individuals with the Omicron variants. IIT Delhi has filed an Indian patent application for the same and is in the process of initiating talks with potential industry partners.

IIT Delhi had earlier obtained ICMR approval (first academic Institute in India to do so) for an RT-PCR kit for the diagnosis of SARS-CoV-2, which was successfully launched in the market.

Some examples of Development/ Investigative Projects at FITT

Sl No	PROJECT TITLE	PI/ Dept/ Centre
1	Advise related to patent	Prof A Ramanan, CHY
2	Aerial computational 3D display with ability to take touch input	Prof K Khare, PHY
3	Image reconstruction for inline particulate imaging system	Prof K Khare, PHY
4	Performance evaluation of engine coating fluid	Prof PMV Subbarao, ME
5	Computer graphics and animation advising for augmented reality	Prof R Narain, CSE
6	ETP adequacy, performance assessment and water audit of Mehasana District Co-operative Milk Producers' Union Limited	Prof V Kumar, CRDT
7	Impact assessment of e-skilling on futuristic skills through common service centers under CSR activity	Prof J Kumar. DOD
8	Development of SDG-2 Dashboard	Prof NB Bolia, ME
9	Developing garment size charts for male Indian motorcyclist	Prof D Gupta, TT
10	Designing for users with empathy & taking the entrepreneurial route to create impact	Prof VM Chariar, CRDT
11	Air pollution audit performance evaluation of concurrent air pollution control system and impact assessment	Prof V Kumar, CRDT
12	Analyzing problems associated with recominant protein expression and improving product quality	Prof KJ Mukherjee, DBEB
13	Validation of DATUM	Prof H Kodamana, CHEME
14	Sulphide/Sulphur removal from carbidge plant waste water (Lagoon/Decanter outlet)	Prof Sreedevi U, CHEME
15	Service Life of TA pins	Prof P Mahajan, AM
16	Solar Power Horticulture Cold chains (Sol-Tech)	Prof VK Vijay, CRDT

17	Study of post-consumer beverage packaging waste management in India and exploring suitable tools to facilitate high end recycling	Prof J Jain, DMSE
18	Analysis followed by laboratory and field trails in deep stroage technologies	Prof AK Jain, EE
19	Development of electric drives for various applications	Prof AK Jain, EE
20	Corning AFR research for transport effects and novel applications (Phase-II)	Prof S Roy, CHEME
21	Studies on use of higher ethanol fraction in commercial gasoline vehicles using special conversion kits	Prof PMV Subbarao, CRDT
22	Testing protocol and standards for estimation of PCR content in product	Prof L Nebhani, DMSE
23	A comparative study on the performance of products respectively made of primary and secondary-Cu	Prof S Neelakantan, DMSE
24	Characterization of BR0 samples	Prof P Mahajan, AM
25	Consultation Visit to RSPL Facility	Prof A Rawal, TFE
26	Simulation of integrated deployment of EVCI, RE and storage in a building	Prof D Rakshit, DESE
27	Technical analysis and vetting of the estimate of construction of 33/11 KV sub-station	Prof S Mishra, EE
28	To identify potential Metal-Organic Frameworks (MOFs) for water treatment molecular modelling/simulation studies	Prof S Bhattacharya, PHY
29	Inspection of Grossly Pollution Industries (GPIs) discharging into main stem of river Ganga and its tributaries	Prof V Kumar, CRDT
30	Development of technology for replacement of currently used phenolic resin in friction paper manufacturing	Prof J Bijwe, CART
31	Designing and development of Higher Performance Fabric for National Flag	Prof B Kumar, TT
32	Design and development of a pyrolysis reactor for processing RWA waste for biochar production	Prof P Kaushal, CRDT
33	Advancing research on deep generative models for unknown distributions	Prof AP Prathosh, EE
34	Development of technology for replacement of currently used phenolic resin in friction paper manufacturing	Prof J Bijwe, CART
35	Development of a novel low-cost Al alloy from primary route with better performance than ADC12	Prof J Jain, DMSE
36	Design and development of camera system for biomedical applications	Prof M Sarkar, EE
37	Towards microscopic investigation of boundary lubrication mechanisms of automotive lubricant additives using in situ scanning probe microscopy	Prof NN Gosvami, DMSE
38	Organo-mimetic microfluidic culture Platform-1	Prof N Singh, CBME
39	Lab scale demonstration of technology for manufacturing of non-alocholic food products from mahua flowers	Prof JK Sahu, CRDT
40	Linking physic-chemical of calcined clay to performance of LC3	Prof S Bishnoi, CE
41	Development a Technical paper on the present status of Assistive Technology (AT) related to various disabilities covering, gaps, challenges and missing links in SEAR member states	Prof PVM Rao, DOD
42	Erosive wear studies on the SLB identified materials	Prof D Kumar, CART
43	Phase-II: Seamless environmental management system (SENSE) for West Bengal	Prof S Dey, CAS
44	Drug repurposing in mycrobacterium tuberculosis targeting its proteome essential for growth and survival	Prof SE Hasnain, DBEB
45	Identification of functional roles played by uncharacterized members of PE/PPE family of mycobacterium tuberculosis	Prof SE Hasnain, DBEB
46	Development of silica and nanocarbon aerogel as thin-film thermal insulator with embedded heaters to form new heater system	Prof J Jacob, DMSE
47	Limestone Calcined Clay Cement Technology Resource Centre (LC3 TRC)	Prof S Bishnoi, CE
48	Organization of Road Safety Inspection and Discussion of Identified Blackspots-Phase-II	Prof G Tiwari, TRIPP

HAPPENINGS

National Health Authority (NHA) and IIT Delhi join hands to scale high-potential healthcare innovations with a $100+ million fund raised from private sector and development funders under the SAMRIDH scheme. Through a blended financing facility, this partnership will support innovators and entrepreneurs in their efforts to further improve healthcare delivery in India. Recognising the role of innovations to strengthen India's response to the COVID-19 crisis and preparedness for emerging healthcare needs, National Health Authority (NHA) has signed a Memorandum of Understanding (MoU) with IIT Delhi. Through this partnership, NHA will be a technical collaborator on the U.S. Agency for International Development (USAID)-supported by SAMRIDH Healthcare Blended Financing Facility. IIT Delhi serves as the hosting entity for SAMRIDH.

MOUs with FITT

Rapid Antigen Testing facility for Covid-19 was inaugurated at IIT Delhi by Prof V. Ramgopal Rao, Director, IIT Delhi on August 31, 2021. The RAT kit developed by the Institute is being used in this testing facility managed by JITM Skills.

MoU signed between FITT, IIT Delhi and M/S. Rusicaa Beverages PVt Ltd for commercialisation of Mahua Nutra Drinks in Jharkhand on September 16, 2021

Dr Anil Wali, MD FITT signed an MoU with Mr AS Mehta, President & Director, JK Paper on October 7,2021 in the presence of Prof V Ramgopal Rao, Director IITD for establishing a COE in Paper and Packaging

IntelliSmart Infrastructure Private Limited & FITT have signed MoU on December 10, 2021 to carry out advanced research for smart grid solutions

SNIPPETS

FITT invites proposals under the 20th Bio-technology Ignition Grant (BIG) Scheme of BIRAC from January 2022.

For details: www.fitt-iitd.in

CORPORATE MEMBERSHIP OF FITT

FITT invites the industry/industry associations/R&D organisations and financial institutions to become corporate members of FITT at a nominal annual subscription. A corporate client can participate in technology transfer and joint R&D programmes of the Institute on a priority basis with FITT providing the interface. Membership form can be downloaded from www.fitt-iitd.in

NEWS AND ANNOUNCEMENT

President of India, Shri Ram Nath Kovind presents Padma Shri to Dr Sujoy Kumar Guha for Science and Engineering. He is a Professor of Biomedical Engineering at IIT Delhi and Honorary Professor at AIIMS…

Source: Internal, IIT Delhi- November 8, 2021

Professor Ashok K Ganguli, Institute Chair Professor of Chemistry (HAG) and Deputy Director (Strategy & Planning), IIT Delhi has been selected by the Materials Research Society of India for the Distinguished Materials Scientist of the Year Award 2021…

Source: Internal, IIT Delhi- December 4, 2021

Prof V Ramgopal Rao, Director IIT Delhi inaugurated an Advanced Electrical Characterization Facility Inaugurated at IIT Delhi on September 21, 2021…

Source: Internal, IIT Delhi

IIT Delhi's State of the Art Research & Innovation Park Wins Prestigious Façade Project of the Year Award 2021

The Park will focus on innovation and product development where the institute researchers, corporates, government agencies and startups would interact and enable creation of advanced technological solutions. IIT Delhi's interface body the Foundation for Innovation and Technology Transfer (FITT) is inviting industry and startups to come on board for deeper engagement with the Institute…

Source: Internal, IIT Delhi – Decmber 13, 2021

10th edition of POSOCO Power System Awards at ICPS

POSOCO Power System Awards (PPSA) - 2022 concluded with the award ceremony at the 9th International Conference on Power Systems, 2021 (ICPS 2021) held on December 16, 2021. 15 awardees were shortlisted in the Doctoral Category and 15 awardees were shortlisted in the Master Category.

Link for award ceremony: https://www.youtube.com/watch?v=qwnrRceiCpc

IIT Delhi Researchers Develop Catalytic Technology for Sustainable Production of Chiral Active Pharmaceutical Ingredients

An IIT Delhi research group led by Prof. Kuntal Manna from the Department of Chemistry and his PhD students – Neha Antil and Rajashree Newar – has developed a catalytic technology for the sustainable and economical synthesis of chiral molecules. The Science and Engineering Research Board (SERB), a statutory body of the Department of Science and Technology (DST), Government of India, has funded this research work…

Source: Internal, IIT Delhi- October 1, 2021

IIT Delhi tops Indian institutes' rise in THE global employability ranking

Ranked 27th, the Indian Institute of Technology (IIT) Delhi leads Indian institutions' rise in the latest annual Global Employability University Ranking and Survey (GEURS) on the back of subject specialisation and graduate skills…

Source: Business Standard- November 25, 2021

IIT Delhi emerges as a breeding ground for innovation with special emphasis on AI

IIT Delhi has emerged as a breeding ground for innovation, experimentation and development of various advanced technology-backed solutions. In the wake of changing dynamics and needs, owing to the onset of the pandemic and other multitude of challenges, the institute has played a key role in bridging the gap to cater to the new-age problems in recent times. The institute has laid special emphasis on artificial intelligence in this regard…

Source: https://edtimes.in/iit-delhi-emerges-as-a-breeding-ground-for-innovation-with-special-emphasis-on-ai/

IIT Delhi, RDSO Researchers Develop Easy to Use Train Simulation Software 'Runtrain to Help in Train Timetabling Methods

Researchers from IIT Delhi and Research Designs and Standards Organisation (RDSO), a unit of Ministry of Railways, have collaborated and developed a train simulation software named 'Runtrain#' that outputs results, which can be incorporated into timetabling methods. Runtrain# simulation software is an update of 'Runtrain' software being used by the Indian Railways since 1990s. The simulation software Runtrain# has been developed under the guidance of Prof Subir Kumar Saha, Principal Investigator, and Prof Satinder Paul Singh, Mechanical Engineering Department, IIT Delhi. The other team members include Bhanu Vardhan Chennoju, Shashwat Jain, Vishnu Sukumar, and Rajeevlochana G Chittawadigi…

Source : Internal, IIT Delhi - September 8, 2021

Publication From FITT Corporate Member: TechInvention

Capacity Building for Vaccine Manufacturing Across Developing Countries: The Way Forward

The devastation unleashed by SARS-CoV-2 pandemic as well as by other periodically emerging and re-emerging infectious pathogens in low- and middle-income countries remains unprecedented. The pandemic has made us realize the capacity crunch for vaccine manufacturing globally which largely affected the accessibility of vaccines in these countries. A robust solution to address this grim issue is to have indigenous vaccine manufacturing which will reduce the dependence on imports and achieve self-sufficiency. The review article highlights the challenges and possible solutions in setting up indigenous vaccine manufacturing, case studies on successful capacity building and technology transfer, role of different organizations in capacity building and the way forward which deliberates on the pertinent points which may resolve the conundrum of vaccine inequity…. **Human Vaccines & Immunotherapeutics**

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