MANIPAL UNIVERSITY
JAIPUR

SDG 7

7 AFFORDABLE AND CLEAN ENERGY

SUSTAINABLE DEVELOPMENT GOALS

REPORT 2022

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SUSTAINABLE DEVELOPMENT GOALS

SDG7 Access to affordable, dependable, sustainable, and modern energy is the seventh Sustainable Development Goal. Manipal University Jaipur's faculty and students are dedicated to studying and creating renewable energy sources, including as biofuels and biogas, to assist communities in making the switch to renewable energy sources. Manipal University Jaipur has numerous policy initiatives, and practices enacted and introduced over the last decade. These policies and acts have focused either individually on an environmental sector like water or air, or they have broadly targeted the entire value chain of the energy sector.

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Scholarly output for SDG 7

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7 AFFORDABLE AND CLEAN ENERGY

Activity of Manipal University Jaipur

Within: **SDG 7: Affordable and Clean Energy** | Year range used for metrics: 2020 to 2022 | Analyze Topic worldwide

Summary | Compare to your Institution

+ Add Summary to Reporting

Performance

+ Add to Reporting

288
Scholarly Output

1.71
Field-Weighted Citation Impact

45
International Collaboration

View list of publications

6,158
Views Count

2,470
Citation Count

Activity of Manipal University Jaipur

Within: **SDG 7: Affordable and Clean Energy** | Year range used for metrics: 2020 to 2022 | Analyze Topic worldwide

Summary | Compare to your Institution

Collaboration

+ Add to Reporting

International Collaboration

Publications co-authored with Institutions in other countries/regions

Manipal University Jaipur:
15.6%

Academic-Corporate Collaboration

Publications with both academic and corporate affiliations

Manipal University Jaipur:
1.7%

Top 15 keyphrases

Top 15 keyphrases by relevance, based on 288 publications

- Solar Energy
- Solar Energy Conversion
- Solar
- Solar Cell
- Energy
- Energy Gap
- Renewable Energy Source
- Renewable Energy

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Program offered in SDG 7

Sr. No.	Name of Course	Course Code
1	RENEWABLE ENERGY RESOURCES	EE1653
2	UTILIZATION OF ELECTRIC POWER	EE1661
3	DISTRIBUTED ENERGY RESOURCES	EE1663
4	ELECTRICAL ENERGY SYSTEMS	EE1691
5	POWER SYSTEM ENGINEERING	EE1702(N)
6	POWER SYSTEM OPERATIONS & CONTROL	EE1703(N)
7	SMART GRID SYSTEMS	EE1763
8	SOLAR PHOTOVOLTAICS	EE2080
9	FUNDAMENTALS OF RENEWABLE ENERGY SOURCES	EE2082
10	GENERATION TRANSMISSION & DISTRIBUTION	EE2202
11	ELECTRIC VEHICLE TECHNOLOGY	EE6104
12	ELECTRIC DRIVE I LAB	EE6130
13	ENERGY STORAGE DEVICES	EE6245
14	INTELLIGENT CONTROL SYSTEMS	EE6281
15	SOLAR ENERGY SYSTEM AND DESIGN	EE8017
16	ENERGY CONSERVATION, AUDIT AND MANAGEMENT	ME1694
17	RENEWABLE ENERGY SYSTEMS	ME1758
18	RENEWABLE ENERGY AND ENERGY HARVESTING	PY2141
19	ENVIRONMENTAL ENGINEERING - I	CV1504
20	ENVIRONMENTAL ENGINEERING LABORATORY	CV1532
21	ENVIRONMENTAL IMPACT ASSESSMENT	CV1590

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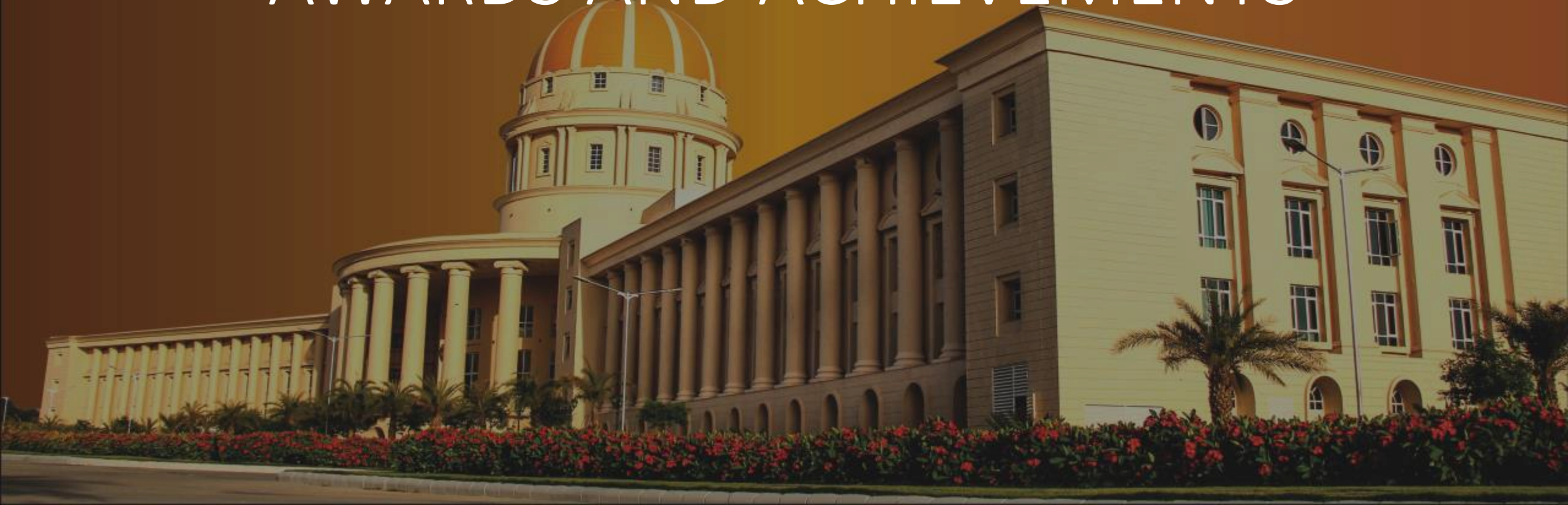
AWARDS AND ACHIEVEMENTS



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MUJ: Awards & Achievements

GRIHA AWARD

First University in the country to be awarded GRIHA award for integrated Water Management.

LEED INDIA PLATINUM Award .

Manipal University has been conferred with this award being the first campus in the country to do so for Green Building . Based on review done by IGBC on the credits submitted by the university, which were evaluated against the rating system for certifying Green Buildings.

GRIHA FIVE STAR RATING

The first University in the country to receive this award for Energy Conservation and Environment Friendly Design.

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MUJ: Awards & Achievements

'Swachhta' Ranking
Award 2017 by **Ministry of HRD**

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Recognitions and Awards (Regulators and Local Community)

Ranked 2nd all over India in Swachhta Ranking 2017

Ranked 4th all over India in Swachhta Ranking 2018

Ranked 4th all over India in Swachhta Ranking 2019

IGBC Performance Challenge 2020 for Green Built environment- Excellence Award'

Outlook-ICARE Ranking 2020
THE BEST PROFESSION COLLEGES

3.5 Star IIC Rating of MUJ for Academic Year 2019-20

MUJ ARIIA Rankings 2020

Manipal University Jaipur Supports Start-ups for a Low-Carbon Economy

Manipal University Jaipur is becoming engines of change by supporting start-ups committed to building a low-carbon economy and green technologies. Through incubator programs, research collaborations, funding access, and business development support, Manipal University Jaipur is nurturing innovation with the potential to revolutionize the way we address environmental challenges. The combined efforts of universities and environmentally-focused start-ups are paving the way for a more sustainable and eco-conscious future, where innovation and entrepreneurship are driving forces for positive change. Manipal University Jaipur is actively fostering an entrepreneurship culture and providing vital support to start-ups dedicated to creating a low-carbon economy or developing green technologies.

Start-ups pioneer groundbreaking technologies and solutions that can accelerate the transition to a sustainable, low-carbon economy. These start-ups create employment opportunities and drive economic growth in the region, contributing to both the local and global green economy. Green start-ups focus on reducing carbon emissions, conserving resources, and mitigating environmental damage. Their success translates into tangible environmental benefits. By supporting green start-ups, Manipal University Jaipur inspires future generations of entrepreneurs and innovators to prioritize environmental sustainability in their ventures. Successful green start-ups can become global leaders in their respective fields, influencing industries and governments to adopt eco-friendly practices.

Manipal University Jaipur is leveraging its resources, expertise, and networks to empower start-ups that share their vision of a more sustainable future. Manipal University Jaipur hosts incubator and accelerator programs tailored to green start-ups. These programs offer access to mentorship, funding opportunities, co-working spaces, and a supportive ecosystem that nurtures their growth. Manipal University Jaipur provides start-ups with access to innovative research facilities and faculty expertise. This collaboration can lead to the development of groundbreaking technologies that address environmental challenges. Manipal University Jaipur connects green start-ups with investors, venture capitalists, and grant programs that focus on sustainability and clean technologies. This access to funding is crucial for scaling up innovative solutions. Manipal University Jaipur offers workshops, seminars, and training sessions on business development, marketing, and intellectual property management. These resources help start-ups refine their strategies and navigate the complex business landscape. Manipal University Jaipur hosts events, conferences, and networking sessions that facilitate connections with industry experts, potential partners, and customers. These opportunities can significantly enhance a start-up's visibility and growth prospects.

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Manipal University Jaipur's Plans to Upgrade Existing Buildings for Higher Energy Efficiency

With growing environmental awareness and the urgent need to combat climate change, institutions of higher education are stepping up their efforts to reduce their carbon footprint. Manipal University Jaipur stands as an exemplary in this regard, is leading the charge by unveiling ambitious plans to revamp its infrastructure for a more sustainable future.

Manipal University Jaipur is recognized as an intellectual hub for innovative thinking, research, and knowledge dissemination. However, with great power comes great responsibility, and the institution is increasingly acknowledging its role in addressing the environmental challenges of our time. Enter the visionary Manipal University Jaipur, an institution that has made a bold pledge to transform its campus into a beacon of sustainability. Recognizing the urgency of climate change, the university has committed to upgrading its existing buildings to higher energy efficiency standards over the next decade. The first step in this ambitious journey is conducting comprehensive energy audits of all existing campus buildings. These audits will provide valuable insights into current energy consumption patterns, identifying areas where improvements can be made. Armed with the audit data, Manipal University Jaipur embarks on a journey of retrofitting and renovating existing structures. This includes upgrading insulation, windows, and HVAC systems to meet modern energy-efficient standards. To further reduce the carbon footprint, Manipal University Jaipur has a plan to integrate renewable energy sources such as solar panels and wind turbines on its campus. This initiative will provide cleaner energy and also serve as an educational opportunity for students. The university aims to transform its buildings into "smart" structures by installing advanced building management systems. These systems will monitor energy usage in real-time, allowing for immediate adjustments and optimization. Recognizing the importance of educating the campus community, Manipal University Jaipur plans to incorporate sustainability and energy efficiency into its curriculum. Workshops, seminars, and awareness campaigns will engage students and staff in the sustainable journey.

The benefits of such a comprehensive sustainability initiative extend far beyond the university campus. By upgrading existing buildings to higher energy efficiency standards, Manipal University Jaipur sets a powerful example for the broader community. It demonstrates that sustainable practices are not only environmentally responsible but also economically viable in the long run.

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Physical Infrastructure

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Physical Infrastructure

Student and Faculty Housing 55 Acres

Future Development 33 Acres

Academic Area 66 Acres

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Physical Infrastructure

AREA STATEMENT – ACADEMIC LAND			
PLOT AREA = 2,69,804,00 Sq. Mts. (66.67 ACRES)			
SL. NO	**PARTICULARS**	**GROSS BUILT UP AREA in Sq. Mts.**	**GROSS BUILT UP AREA in Sq. Ft.**
1.	UNIVERSITY ADMIN & LIBRARY BUILDING	23,463	2,52,553.63
2.	ACADEMIC BLOCK – 1	30,628	3,29,677.05
3.	FOOD COURT	7,954	85,616.14
4.	SECURITY	230	2,475.70
5.	WORKSHOP (GROUND FLOOR)	1,388	14,940.13
6.	SUBSTATION	120	1,291.67
7.	D.G. BLOCK	307	3,304.52
8.	DISPENSARY	228	2,454.17
9.	VIP SECURITY BLOCK	62	667.36
10.	ACADEMIC BLOCK – 2	31,952	3,43,928.47
11.	AUTOMOBILE SHED	1,050	11,302.11
12.	FIRST FLOOR WORKSHOP BUILDING	1,542	16,597.95
13.	CHEMICAL ENGINEERING LAB-3	369	3,971.88
14.	CHEMICAL ENGINEERING RESEARCH LAB.	100	1,076.39
15.	FURNITURE YARD	1,050	11,302.11
TOTAL		**1,00,443**	**10,81,159.45**

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Physical Infrastructure

AREA STATEMENT- HOSTEL LAND				
PLOT AREA = 2,22,475.72 Sq. Mts. (54.97 ACRES = 46.64 GHSPL + 8.0 FH + 0.33 JVVNL)				
SL. NO	**PARTICULARS**	**GROSS BUILT UP AREA in Sq. Mts.**	**GROSS BUILT UP AREA in Sq. Ft.**	**NO. OF ROOMS**
1.	B1 BOYS HOSTEL BLOCK	15,809.16	1,70,168.38	475
2.	B2 BOYS HOSTEL BLOCK	12,494.13	1,34,485.69	430
3.	B3 BOYS HOSTEL BLOCK	6,678.43	71,886.02	208
4.	B4 BOYS HOSTEL BLOCK	6,895.22	74,219.53	241
5.	B5 BOYS HOSTEL BLOCK	4,899.50	52,737.77	186
6.	B6 BOYS HOSTEL BLOCK	7,653.44	82,380.94	276
7.	B7 BOYS HOSTEL BLOCK	10,576.79	1,13,847.62	334
8.	G1 GIRLS HOSTEL BLOCK	12,377.59	1,33,231.26	334
9.	G2 GIRLS HOSTEL BLOCK	4,922.74	52,987.93	163
10.	G3 GIRLS HOSTEL BLOCK	4,500.51	48,443.08	171
11.	G4 GIRLS HOSTEL BLOCK	4,773.82	51,384.97	173
12.	BOYS FOOD COURT	7,070.35	76,104.61	
13.	FACILITY BLOCK	1,753.65	18,876.13	
14.	OVERALL SERVICES	2,300	24,756.99	
15.	FACULTY HOUSING FH-1	3,631.40	39,088.06	
16.	FACULTY HOUSING FH-2	5,444.85	58,586.59	
16.	GUEST HOUSING	1,988.90	21,408.34	
TOTAL		**1,13,770.48**	**12,24,593.96**	**2991**

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Physical Infrastructure

Sl. No.	Building	Type of Unit (Room/Residence)	No. of Units	Area of Individual Unit (Sq. Mts.)	Gross Built-up Area, including lobby (Sq. Mts.)
1.	MUJ Guest House	Suit Room	5	46	1,988.90 Sq. Mts. 21,400.56 Sq. Ft.
		Executive Room	20	19	
2.	Faculty Housing: Block-1 (FH-1)	4 - BHK	1	274.06	3,631.40 Sq. Mts. 39,073.86 Sq. Ft.
		3 - BHK	6	130.06	
		2 - BHK	10	102.19	
		1 - BHK	5	62.80	
3.	Faculty Housing: Block-2 (FH-2)	3 - BHK	5	143.99	5,444.85 Sq. Mts. 58,586.59 Sq. Ft.
		2 - BHK	28	111.48	

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Physical Infrastructure

CLASSROOMS / LABS			
SL. NO	**PARTICULARS**	**CLASSROOMS**	**LABORATORIES**
1.	ACADEMIC BLOCK - 1	57	46
2.	ACADEMIC BLOCK – 2	88	40
3.	WORKSHOPS	14	
4.	SMT SHARDA PAI AUDITORIUM	271 (SEATING CAPACITY)	
5.	DR TMA PAI AUDITORIUM	411 (SEATING CAPACITY)	
6.	DR RAMDAS PAI AMPHITHEATRE	1000 (SEATING CAPACITY)	

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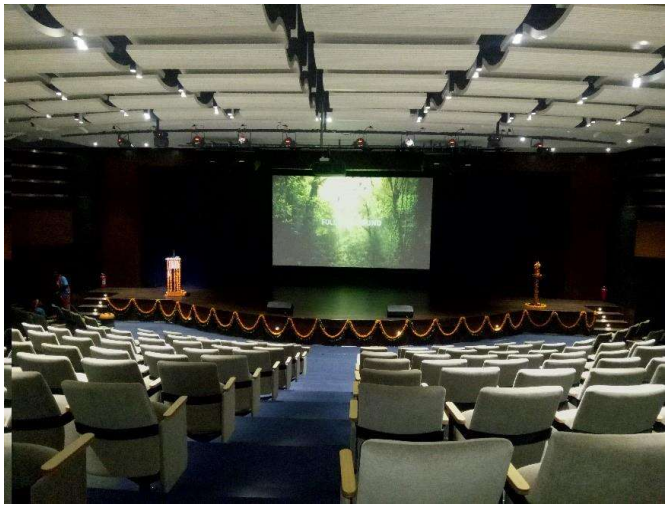
Physical Infrastructure



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Electricity Infrastructure

Electricity:

Power Supply : 33KV supply from JVVNL with CMD 4000 KVA
Connected Load : 7070kW
DG Back up : 1000 KVA DG Back up (2 Nos. of 500kVA DG set)
Solar Power : 1527 KW

Sl. No.	Location		Capacity in KWp	Total kWh	By on OPEX
1	Academic Block 1 (Flat roof)		354	850	M/s. Cleanmax
2	Admin Block (Flat roof)		200		
3	Academic Block 2	NAB 1 (Flat roof)	200		
		NAB 2 (Flat roof)	96		
		NAB 3&4 (Flat roof)	80.64	677.12	M/s. Renew Power
		NAB 3&4 (Elevated)	145.28		
4	Automobile Lab (Flat roof)		34.56		
5	Car Port A	Near Admin Block	235.2		
6	Car Port B	Near Academic Block 1	181.44		
	Total capacity			1527.12	

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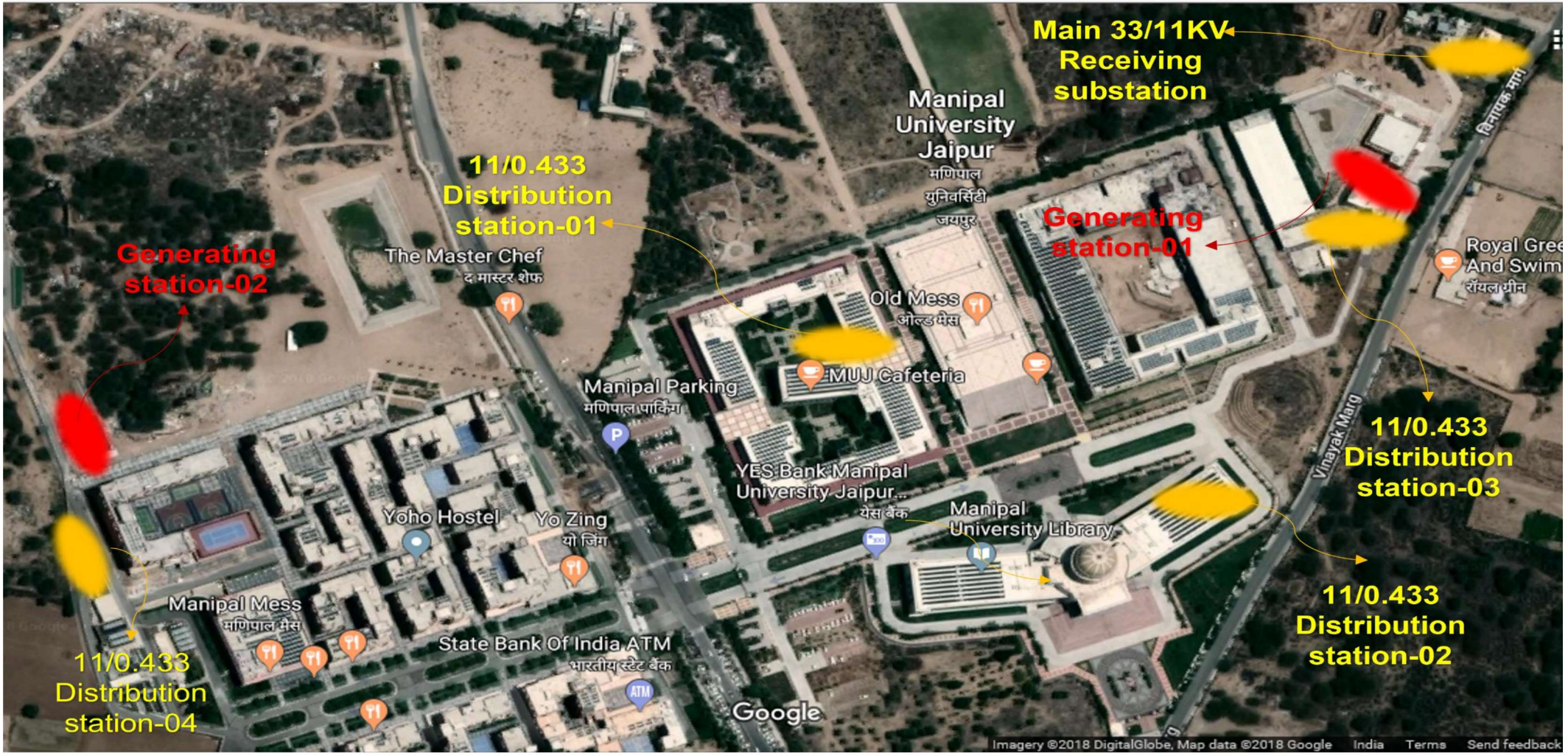
Electricity Infrastructure



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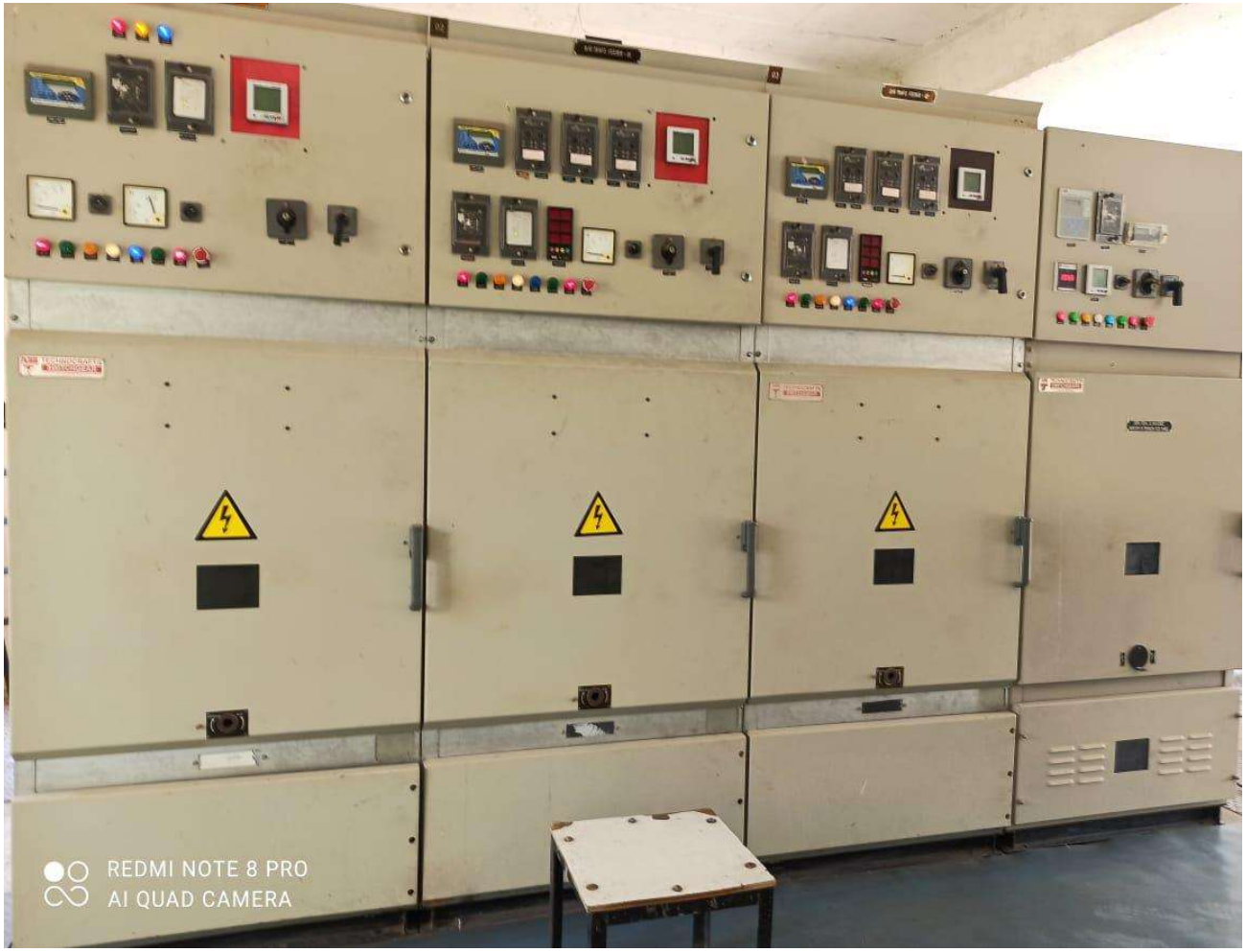
Electricity Infrastructure



Solar Infrastructure

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Water Supply Infrastructure

Water Source:

Tube wells: 05 Nos. (440 feet depth)

Water Treatment Plant:

WTP: Capacity 200 KLD + 80 KLD

Raw Water Tank –

Filter feed pump – Pressure Sand filter –

Activated Corban filter – Softener – Treated

Tank -

to All Over Head Tanks (Domestic Tanks) by

Domestic water transfer pump

Equipment	Capacity in KLD	Location
WTP	200	Near DG Block
	80	*GH*
Total	**280**	

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Sewage Infrastructure

Sewage Treatment Plant:

STP: Capacity 150 & 350 KLD MBR Based Process

Coarse Screen – Collection tank – Fine Screen – Oil Skimmer – Equalization Tank – Mini Screen – Aeration Tank – MBR Tank – Permeate Tank to All Over Head Tanks (Flush Tank) by Flush water transfer pump.

The STP's Treated water has been used for Flush & Drip Irrigation

Equipment	Capacity in KLD	Location
STP	350	Near Estate Office
	150	
Total	**500**	

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Water Supply Infrastructure

OHT Capacity @ MUJ					
Block	Zone	**Capacity in KL**			
		AC	Fire	Domestic	Flush
Administrative Block	Left Wing	10	-	5	8
	Right Wing	10	-	5	8
	Board room	-	-	0.25	0.25
Academic Block 1	Wing A	10	-	10	10
	Wing B	10	-	10	10
Academic Block 2	Phase 1 & 2	-	30	34	17.6
	Phase 3 & 4	-	65	45	20
Total		**40**	**95**	**109.25**	**73.85**

Tank Capacity (UGR) - MUJ			
Blocks	Unit	Raw Water	Treated Water
MUJ Academic - WTP	CUM	680	180

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Elevators

ELEVATORS		
1	24 PAX,1632 Kg.	1A
2	24 PAX,1632 Kg.	1A
3	24 PAX,1632 Kg.	1C LW
4	24 PAX,1632 Kg.	1C LW
5	24 PAX,1632 Kg.	1C RW
6	24 PAX,1632 Kg.	1C RW
7	500Kg	Food Court
8	500Kg	Food Court
9	24 PAX,1632 Kg.	2AB
10	24 PAX,1632 Kg.	2AB
11	24 PAX,1632 Kg.	WORKSHOP
12	24 PAX,1632 Kg.	2AB
13	24 PAX,1632 Kg.	2AB
14	24 PAX,1632 Kg.	AUTO WORKSHOP
15	15 PAX,1020 Kg.	FH1
16	15 PAX,1020 Kg.	GH
17	15 PAX,1020 Kg.	FH2
	Total	**17 Elevators**

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HVAC Infrastructure

Details of Air Conditioning System							
		1AB	1C	2AB	FH1 , FH2 and GH	External Area	
Sl No	Type of Equipment	Total capacity in TR	Total capacity in TR	Total capacity in TR	Total capacity in TR	Total capacity in TR	Total
1	Total Chillers	480	240	810			1530
2	Exhaust and AHUs	601	127	422	10.5	25	1185.5
3	Total Cassette Units	170	324.95	966			1461
4	Total Regular Split Unit	24	26.5	17.5		19	68
5	VRV & Inverter Units	105	30	26	236.7		498.7
6	Duct able and Scroll with AUH Units		30				30
	Total Tr ->	**900**	**787.95**	**1431.5**	**247.2**	**44**	**3409.7**

Detail of External Area	
1	Security Block
2	Workshop
3	Main Dispensary
4	Food Court
5	VIP Security Block
6	Workshop, Automobile Workshop, Chemical Engineering Lab

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HVAC Infrastructure

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Power Control Panels

Power Control Panel	Number
33 KVA – 2 Panels	5 VCBs 33 KVA
11 KVA HT Panel – 6 Panels	16 VCBs 11 KVA
DG- EB ATS Panel – 1 Panel	2 VCBs
DG Synchronization Panel – 1 Panel	5 ACBs
LT Panels – 5 Panels	10 ACBs
Power control panels installed in MUJ campus and faculty housing including 1AB, 2AB, Admin, Food Court, Workshop, Security, Estate Office & STP and FH etc.	

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Power Control Panels

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Transformers

Sr. No.	Location	Capacity	Rating	Make
1	DG BLOCK	2500KVA	33KV/.415KV	Schneider
2	Sub station	2500kva	33/11KV	VOLTAMP
3	Sub station	2000kva	33/11KV	VOLTAMP
4	DG BLOCK	1500KVA	.415/11KV	
5	DG BLOCK	500KVA	11/.415KV	
6	1AB	1000KVA	11/.415KV	
7	1C	1000KVA	11/.415KV	

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Diesel Generator Set

MUJ DG Sets	Make	Capacity
DG1	Greaves Cotton	500 KVA
DG2	Greaves Cotton	500 KVA

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UPS

Sr No	Location	UPS with Capacity
1	AB 1	30 KVA
2	AB 1	30 KVA
3	AB 1	30 KVA
4	ADMIN	30 KVA
5	ADMIN	30 KVA
6	ADMIN	30 KVA
7	ADMIN	31 KVA
8	AB 2	40 KVA
9	AB 2	40 KVA
10	AB 2	15 KVA
11	AB 2	15 KVA
12	AB 2	5 KVA
13	AB 1 Room 011	20 KVA
14	AB 2 XRD and FESEM	30 KVA (10kVA each)
14	AB 1 Virtual Classroom	7.5 KVA
	Total Capacity	**382.5 KVA**

Uses of UPS supply in campus

1. CCTV Command Center
2. Server, Data and Communication Center
3. Board Room 5th Floor and Third Floor
4. Auditorium AV System
5. Computer Labs and Sophisticated Lab
6. Emergency Light & Power in Buildings

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Academic Block 3

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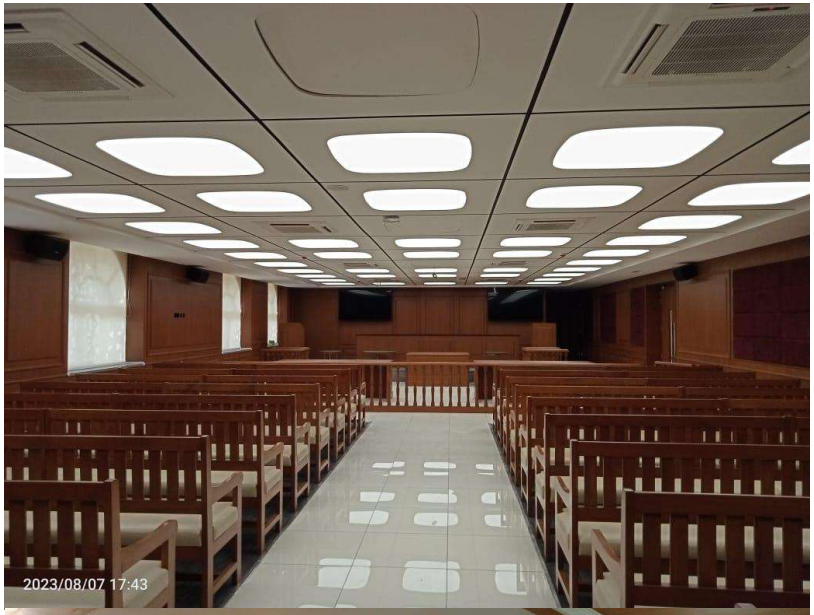
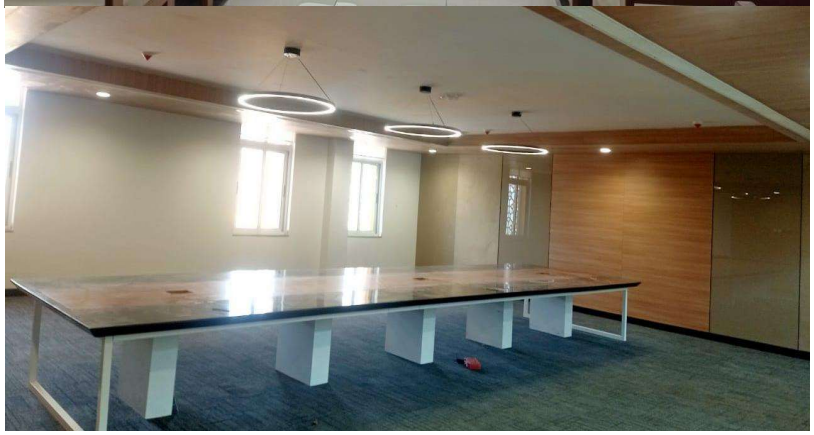
Academic Block 3





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Academic Block 3

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Academic Block 3

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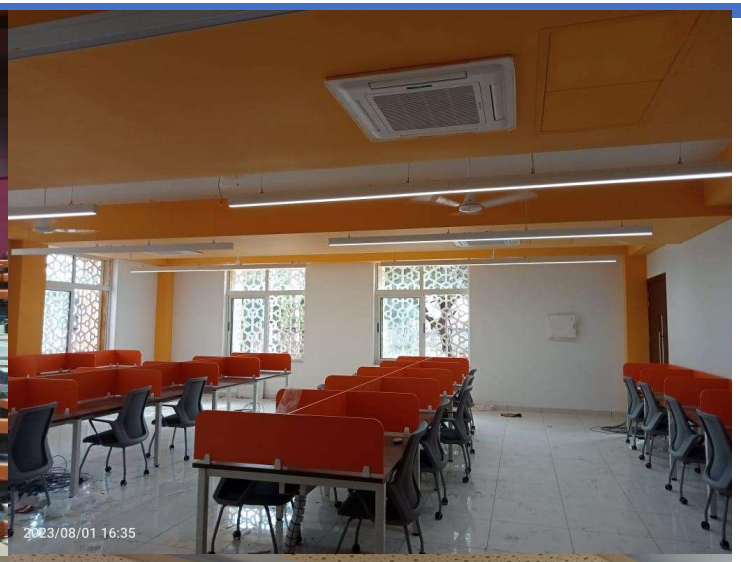

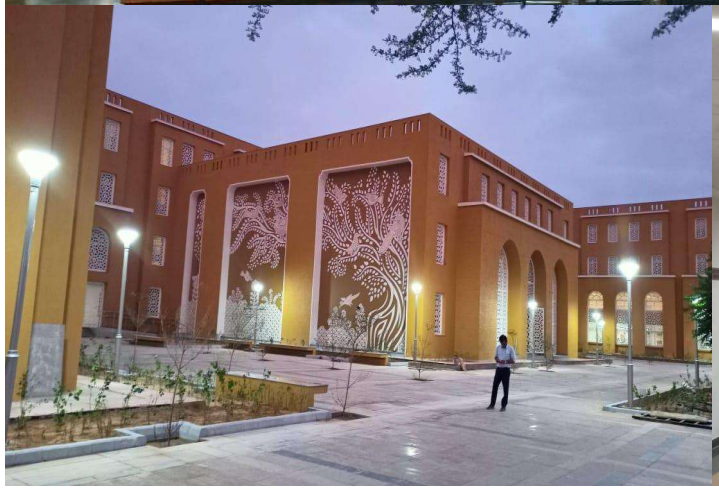

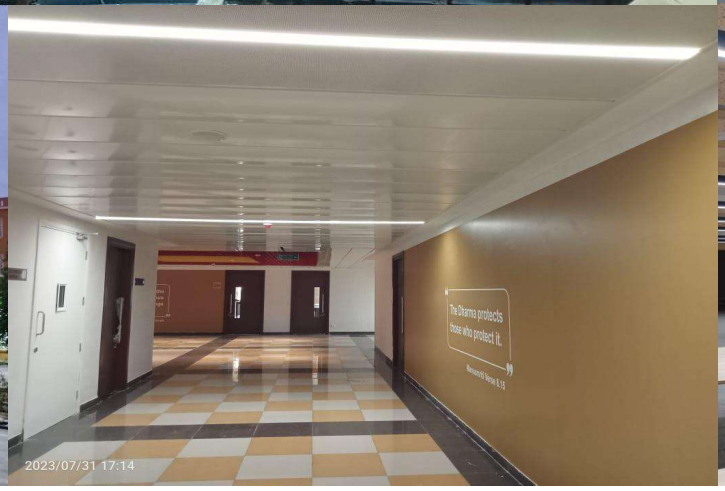

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Manipal Jaipur University New Build Standards

In an era marked by climate change and environmental concerns, universities worldwide are increasingly recognizing the importance of sustainable practices, not just in the classroom but also in their physical Infrastructure. One key aspect of this commitment is the prioritization of constructing new buildings to meet sustainable standards. Manipal University Jaipur emphasizes sustainability in building projects.

Manipal University Jaipur recognizes the imperativeness for sustainable building. Universities are seen as educational and research leaders, and they are expected to lead by example in environmental stewardship. Building sustainably reduces the Manipal University Jaipur's carbon footprint, energy consumption, and waste generation, aligning with global efforts to combat climate change. Sustainable buildings often feature energy-efficient designs and technologies, which lead to reduced operational costs over time. This frees up resources for Manipal University Jaipur to invest in their core missions of teaching and research. Keeping in mind that students and faculty increasingly value sustainability when choosing educational institutions. Manipal University Jaipur prioritizes green building and enhances their reputation as sustainable institutions. Manipal University Jaipur implements building codes and environmental regulations. Constructing sustainable buildings ensures university remains compliant and avoids potential legal issues. Manipal University Jaipur's buildings typically have lower energy and water consumption, resulting in reduced utility bills. These cost savings can be reinvested into academics and campus improvements. Manipal University Jaipur provides a healthier and more comfortable environment for students, leading to improved well-being and academic performance. Manipal University Jaipur's buildings serve as living laboratories for students and researchers to study sustainable technologies, materials, and design principles. Manipal University Jaipur's buildings work as a platform to engage with the local community and promote sustainable practices beyond campus borders.

Universities play a vital role in shaping future generations and contributing to a sustainable future. By prioritizing the construction of new buildings to sustainable standards, Manipal University Jaipur set a positive example for students, faculty, and the broader community. The long-term benefits, from reduced operating costs to enhanced reputation, demonstrate that sustainability is not just an ethical choice but also a strategic one for universities. As climate change continues to be a pressing issue, Manipal University Jaipur must continue to lead the way in sustainable building practices, creating a more sustainable and environmentally responsible world.

GRIHA AWARD

First University in the country to be awarded GRIHA award for integrated Water Management.

GRIHA FIVE STAR RATING

The first University in the country to receive this award for Energy Conservation and Environment Friendly Design

LEED (Leadership in Energy and Environmental Design) INDIA PLATINUM Award.

Manipal University has been conferred with this award being the first campus in the country to do so for Green Building. Based on review done by IGBC on the credits

submitted by the university, which were evaluated against the rating system for certifying Green Buildings.

The detailed explanation at:

https://www.youtube.com/watch?v=F3BrKOi18lE

More details at: https://jaipur.manipal.edu/muj/about-us/awards-and-achievements/griha-leed-platinum-rated- campus.html

GREEN CAMPUS

The Academic and Administrative buildings of Manipal University Jaipur (MUJ) have been awarded a 5-star rating by GRIHA (Green Rating for Integrated Habitat Assessment). Manipal University Jaipur is the first University in the country to receive this honour.
GRIHA was all praise for MUJ, saying **"that this is one of the best projects we have ever rated and the 1st University Campus in India to get a 5 Star Rating."**

The award will be presented to the University on the occasion of its Inauguration on 2 April 2015.

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN (LEED) – PLATINUM RATING

LEED stands for green building leadership. LEED is transforming the way we think about how buildings and communities are designed, constructed, maintained and operated across the globe.
LEED certified buildings save money and resources and have a positive impact on the health of occupants, while promoting renewable, clean energy.
LEED, or Leadership in Energy & Environmental Design, is a green building certification program that recognizes best-in-class building strategies and practices. To receive LEED certification, building projects satisfy prerequisites and earn points to achieve different levels of certification. Prerequisites and credits differ for each rating system, and teams choose the best fit for their project.

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT (GRIHA) – 5 STARS

GRIHA is the National Rating System of India; GRIHA is a Sanskrit word meaning – 'Abode.' Human Habitats (Buildings) interact with the environment in various ways. Throughout their life cycles, from construction to operation and then demolition, they consume resources in the form of energy, water, materials, etc. and emit wastes either directly in the form of municipal wastes or indirectly as emissions from electricity generation. GRIHA attempts to minimise a building's resource consumption, waste generation, and overall ecological impact to within certain nationally acceptable limits / benchmarks.

GRIHA attempts to quantify aspects such as energy consumption, waste generation, renewable energy adoption, etc. so as to manage, control and reduce the same to the best possible extent. GRIHA is a rating tool that helps people assess the performance of their building against certain nationally acceptable benchmarks. It will evaluate the environmental performance of a building holistically over its entire life cycle, thereby providing a definitive standard for what constitutes a **'Green Building'**. The rating system, based on accepted energy and environmental principles, will seek to strike a balance between the established practices and emerging concepts, both national and international. The guidelines/criteria appraisal may be revised every three years to take into account the latest scientific developments during this period.

Adarsh has acknowledged & awarded MUJ campus in the category of "Exemplary **Demonstration of Integrated Water Management**" on February 14th, 2013

GREEN INITIATIVES

- Barrier free campus for differently – abled
- Climate responsive design
- Environment friendly campus
- Use of local materials
- Native species for landscape
- Drip irrigation
- Wastewater recycling
- Natural lighting
- Use of LEDs for energy conservation
- Automatic timer for lighting systems.

WHY DO WE BUILD GREEN?

New buildings are not only a major investment, but they are also a legacy that we will be passing on for decades to come. Our campuses are costly to run and are often used for many hours of the day. When planning for new construction or major renovations, we must consider the lifecycle cost of those buildings, their impacts on the environment, and how they affect and can best serve the many generations that will use these buildings.

Manipal University Jaipur believes universities have accountability for the future. A special role and special responsibility to address challenges as large as climate change by imparting sustainable values to the decision makers of the future.

Building green demonstrates our commitment to sustainability and gives us enormous peace of mind in knowing that the structures we have built are better for the environment, healthier for occupants and save money over the long term.

ENVIRONMENTAL BENEFITS

- Green buildings are designed to use energy and water in a significantly, more measurable, efficient way than conventionally designed buildings

- Green buildings also reduce their waste streams during construction, are built to minimize their impact on the land on which they sit and the ecosystems around them, and are built with sustainably produced, recycled and recyclable materials and products.

STUDENT & TEACHER BENEFITS:

- Green buildings are built and designed with strategies and technologies that aim to improve the quality of indoor air, which could lead to improved student health, test scores and faculty retention
- Green buildings have better lighting, temperature control, improved ventilation, and better indoor air quality
- Help develop environmental consciousness among staff and students alike.

FINANCIAL BENEFITS

- Building green offers dramatic reductions in operations and maintenance costs
- Cost savings are most likely to be fully realised when incorporated at the project's conceptual design phase with the assistance of an integrated team of building professionals. The integrated systems approach aims to design the building as one system rather than a collection of potentially disconnected systems.

MANIPAL UNIVERSITY JAIPUR

Manipal University Jaipur's Proactive Approach to Carbon Management and Reducing CO2 Emissions

Carbon dioxide is a major greenhouse gas responsible for global warming and climate change. While many sectors contribute to CO2 emissions, Manipal University Jaipur, with its energy-intensive operations and large campus, has a substantial impact. To counter this, Manipal University Jaipur is taking decisive steps to measure, manage, and reduce its carbon emissions.

Manipal University Jaipur has made a steadfast commitment to environmental stewardship. Recognizing the urgent need to address climate change, the institution has developed a comprehensive carbon management process as a cornerstone of its sustainability efforts. Manipal University Jaipur has conducted a rigorous assessment of its carbon footprint, encompassing all aspects of campus operations, including energy consumption, transportation, and waste management. This baseline assessment provides valuable data for setting reduction targets. With a clear understanding of its carbon emissions, the university has established ambitious reduction goals. These targets align with international climate agreements and represent a commitment to achieving net-zero emissions over the coming decades.

A significant portion of the university's emissions stems from energy consumption. As part of its carbon management strategy, the institution is investing in energy-efficient technologies, upgrading infrastructure, and optimizing energy usage across campus. To further reduce its carbon footprint, the university is transitioning to renewable energy sources. Solar panels are being integrated into the campus infrastructure to generate clean energy. Recognizing the impact of commuting and travel, the university is promoting sustainable transportation options. This includes expanding public transportation access, installing bike lanes, and incentivizing carpooling. The university is committed to environmentally responsible procurement practices. By sourcing products and materials with lower carbon footprints, it contributes to emissions reduction along the supply chain. While striving for emissions reduction, Manipal University Jaipur acknowledges that some emissions are unavoidable. To address this, it invests in carbon offset projects that capture or reduce emissions elsewhere.

MANIPAL UNIVERSITY
JAIPUR

HVAC Infrastructure

Details of Air Conditioning System							
		1AB	1C	2AB	FH1 , FH2 and GH	External Area	
Sl No	Type of Equipment	Total capacity in TR	Total capacity in TR	Total capacity in TR	Total capacity in TR	Total capacity in TR	Total
1	Total Chillers	480	240	810			1530
2	Exhaust and AHUs	601	127	422	10.5	25	1185.5
3	Total Cassette Units	170	324.95	966			1461
4	Total Regular Split Unit	24	26.5	17.5		19	68
5	VRV & Inverter Units	105	30	26	236.7		498.7
6	Duct able and Scroll with AUH Units		30				30
	Total Tr ->	**900**	**787.95**	**1431.5**	**247.2**	**44**	**3409.7**

Detail of External Area	
1	Security Block
2	Workshop
3	Main Dispensary
4	Food Court
5	VIP Security Block
6	Workshop, Automobile Workshop, Chemical Engineering Lab

MANIPAL UNIVERSITY
JAIPUR

HVAC Infrastructure

MANIPAL UNIVERSITY
JAIPUR

Power Control Panels

Power Control Panel	Number
33 KVA – 2 Panels	5 VCBs 33 KVA
11 KVA HT Panel – 6 Panels	16 VCBs 11 KVA
DG- EB ATS Panel – 1 Panel	2 VCBs
DG Synchronization Panel – 1 Panel	5 ACBs
LT Panels – 5 Panels	10 ACBs
Power control panels installed in MUJ campus and faculty housing including 1AB, 2AB, Admin, Food Court, Workshop, Security, Estate Office & STP and FH etc.	

MANIPAL UNIVERSITY
JAIPUR

Power Control Panels

MANIPAL UNIVERSITY
JAIPUR

Transformers

Sr. No.	Location	Capacity	Rating	Make
1	DG BLOCK	2500KVA	33KV/.415KV	Schneider
2	Sub station	2500kva	33/11KV	VOLTAMP
3	Sub station	2000kva	33/11KV	VOLTAMP
4	DG BLOCK	1500KVA	.415/11KV	
5	DG BLOCK	500KVA	11/.415KV	
6	1AB	1000KVA	11/.415KV	
7	1C	1000KVA	11/.415KV	

MANIPAL UNIVERSITY
JAIPUR

Diesel Generator Set

MUJ DG Sets	Make	Capacity
DG1	Greaves Cotton	500 KVA
DG2	Greaves Cotton	500 KVA

MANIPAL UNIVERSITY
JAIPUR

Lecture Hall Complex

स्वच्छ भारत
एक कदम स्वच्छता की ओर

WORK PROGRESS-Lecture Hall Complex					
ACTIVITY Below Grade Slab		Northern Part	Sourthen Part	Total	
Footing	Total Qty in Cum	1883.00	2256.00	4139.00	90%
	Completed Qty in Cum	1883.00	2256.00	4139.00	
	Percentage Completion	100%	100%	100%	
Backfilling	Total Qty in Cum	9135.00	13387.50	22522.50	
	Completed Qty in Cum	8404.20	13387.50	21791.70	
	Percentage Completion	92%	100%	96%	
Stone Masonary	Total Qty in Cum	169.05	169.95	339.00	
	Completed Qty in Cum	169.05	169.95	339.00	
	Percentage Completion	100%	100%	100%	
Plinth Beam	Total Qty in Cum	135.00	165.00	300.00	
	Completed Qty in Cum	100.00	155.00	255.00	
	Percentage Completion	74%	94%	84%	
Gradeslab PCC	Total Qty in Cum	293.00	331.00	624.00	
	Completed Qty in Cum	174.00	325.00	499.00	
	Percentage Completion	59%	98%	79%	
Gradeslab RCC	Total Qty in Cum	374.80	562.20	937.00	
	Completed Qty in Cum	184.00	550.00	734.00	
	Percentage Completion	49%	98%	73%	
ACTIVITY Above Grade Slab					
Columns upto First Floor	Total Nos.	29.00	51.00	80.00	28%
	Completed Nos.	0.00	35.00	35.00	
	Percentage Completion	0%	69%	34%	
Shear Wall upto First Floor	Total Nos.	8.00	20.00	28.00	
	Completed Nos.	0.00	9.00	9.00	
	Percentage Completion	0%	45%	23%	

First Floor Slab Concrete		
Pour-1	Total Qty in Cum	250
	Completed Qty in Cum	245
	Percentage Completion	98%
Pour-2	Total Qty in Cum	410
	Completed Qty in Cum	0
	Percentage Completion	0%
Pour-3	Total Qty in Cum	90
	Completed Qty in Cum	0
	Percentage Completion	0%
Pour-4	Total Qty in Cum	410
	Completed Qty in Cum	0
	Percentage Completion	0%
Pour-5	Total Qty in Cum	320
	Completed Qty in Cum	0
	Percentage Completion	0%

MANIPAL UNIVERSITY
JAIPUR

HVAC MAINTENANCE ACTIVITY – 1AB

AC Unit installation in Purchase Office

Chiller Cleaning – Right Wing

Expansion Tank Cleaning – 2 AB

MANIPAL UNIVERSITY
JAIPUR

Academic block-1

Before

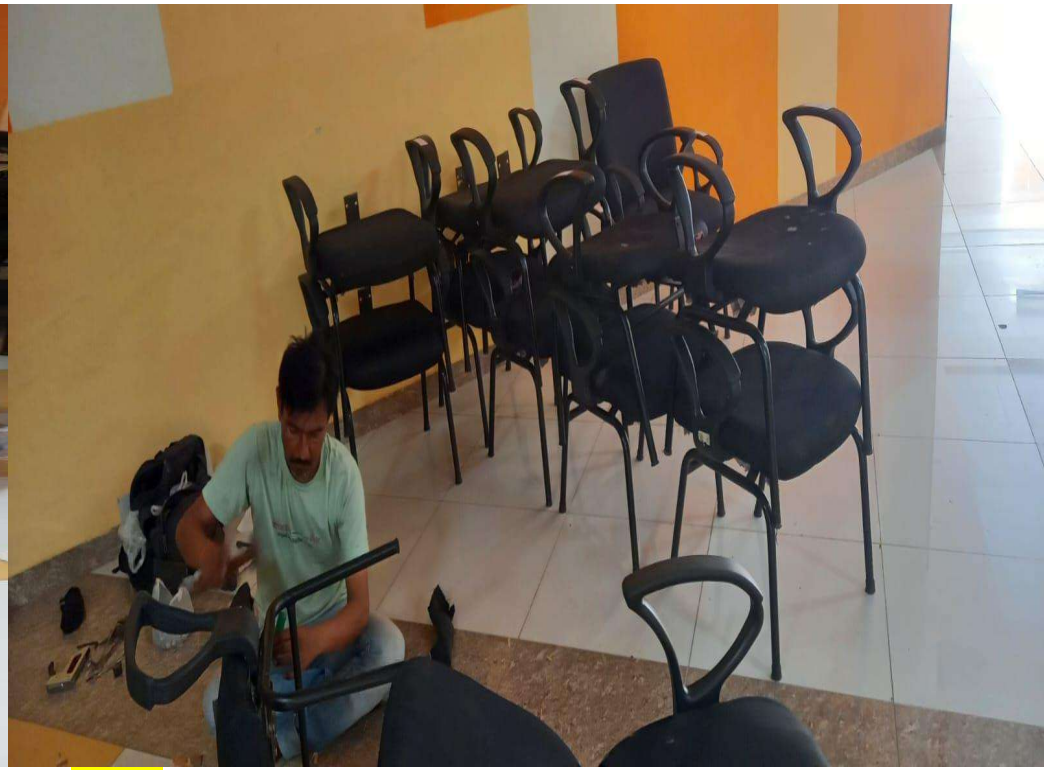
After

Aacademic block-1 terrace

MANIPAL UNIVERSITY
JAIPUR

Academic Block-2

Before



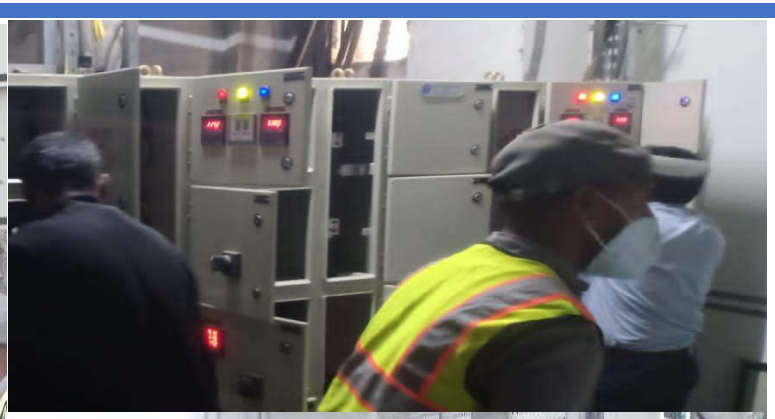
After

Chair reapair

MANIPAL UNIVERSITY
JAIPUR

Power control Panel Maintenance

11KV Panel



LT Panel – DG Block

MANIPAL UNIVERSITY
JAIPUR

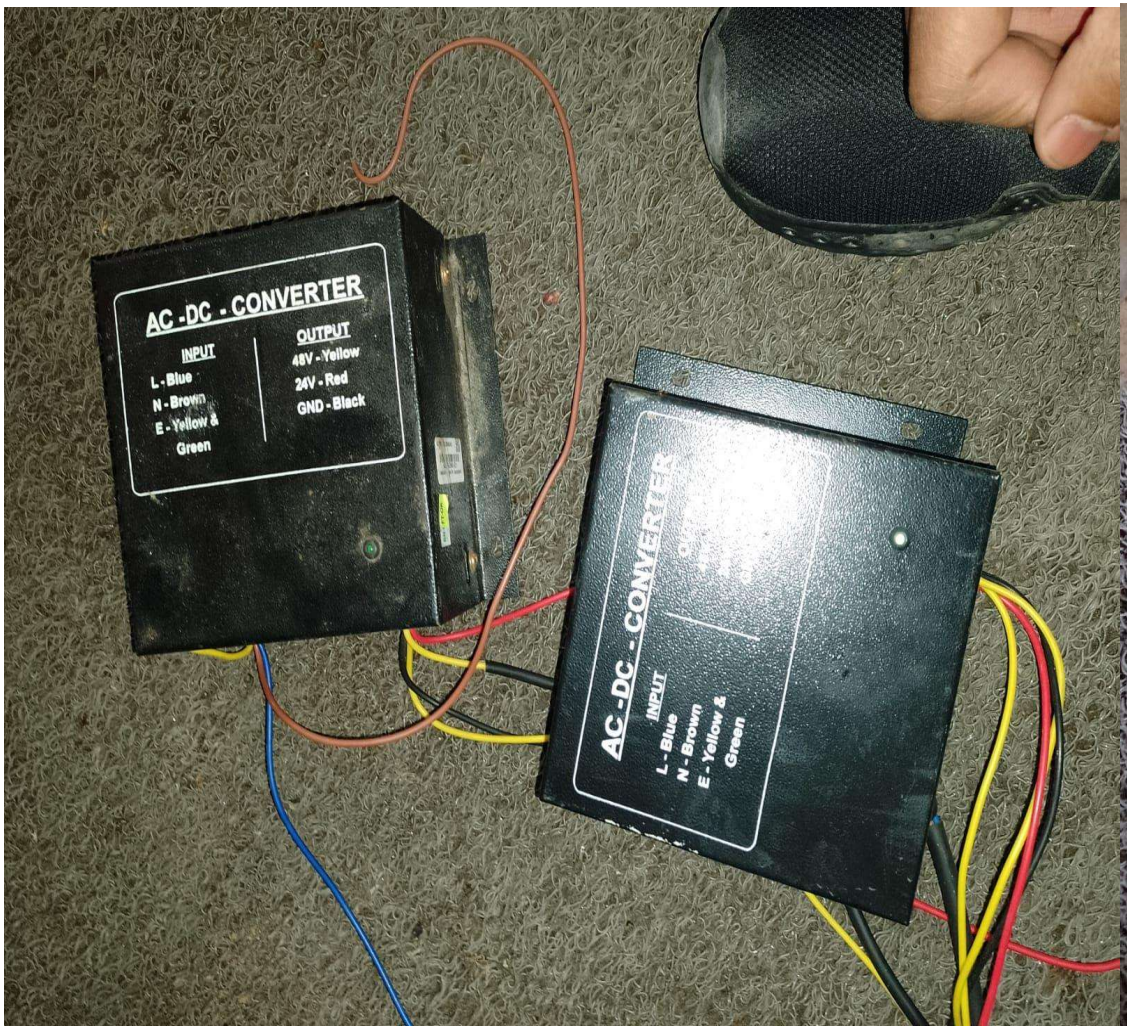
Electrical Maintenance

Aacademic Block-2 room no-27 furniture work

Aacademic block-1 212 furniture work

AC Service – 1 C Admin block 1st Floor

ACADEMIC BLOCK-1 TOILET REPAIR WORK IN PROGRESS

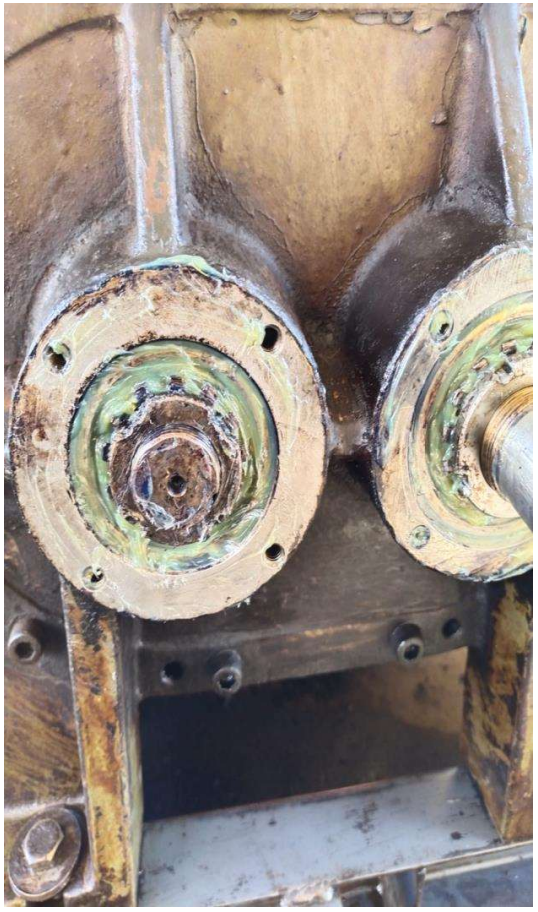


ADMINSTRATIVE BLOCK 1ST FLOOR WATER COOLER REPAIR WORK

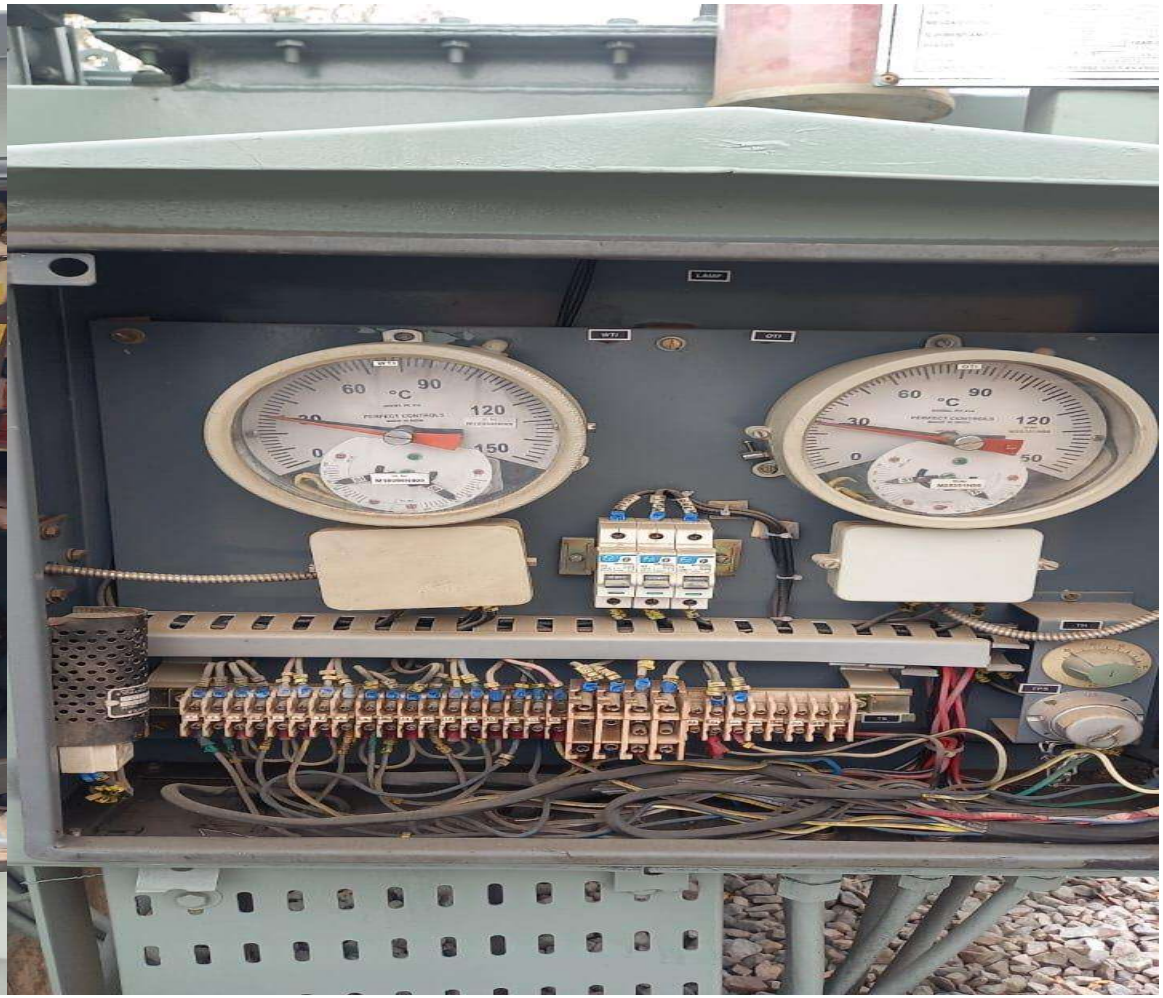
DATA CENTRE AC MAINTENANCE WORK

MANIPAL UNIVERSITY
JAIPUR

MAINTENANCE ACTIVITY


STP Maintenance Activities



TRNSFORMER MAINTENANCE WORK

HVAC Repair and maintenance

Roadmap for Decarbonization of the campus

- Manipal University, Jaipur

WASTE ROADMAP STRATEGIES

Strategy 1: Waste segregation and management

The source separation process involves the segregation of various types of solid waste at the source. By sorting waste, one can identify items that can be reused and set aside items that should be recycled, reducing your overall waste output.

The following should be considered when separating waste:

1. Types of waste (biodegradable and non- biodegradable)
2. Treatment and disposal methods

To implement this strategy, we need following-

- Purchase different types of **dustbins with labels-**
    - I. Dry bin (recyclable waste, paper, cardboard)
    - II. Dry bin (aluminum, glass, plastic)
    - III. Wet bin (food and garden)
    - IV. E waste (cds, wires, electronics)
    - V. Hazardous (medical)
    - VI. Others
- **Third-party contractors** (to collect dry recyclable and e-waste)
- **Quantitate data** (measuring and recording the waste collected + maintain the recycling waste cost)

Total= 70460 Rs

Strategies : **Waste**

Implementation Steps

Step 1- Segregation Bins-
Have color coded dustbins every 150m-300m, so that the users can make the right choice easily.

Step 2- Encourage Participation-
Waste minimization display on the site noticeboard for awareness at site level.

Step 3- Waste Tracking-
It is important to keep track of how much waste the university generates.

Step 4- Waste Management Plan-

- Assign responsibility (set a management team)
- Define target for waste minimization and circularity
- Tracking of waste generated and output created
- Identify the waste destinations and transport modes
- Communication and training to support and encourage participation
- Reviewing of the plan and periodic updating

Step 5- Waste monitoring solutions-
An ultrasonic sensor is used to measure fullness levels. This helps to detect important incidents such as container's waste level, or in situations like fire, or sudden movements.

Initial Cost Estimation

Cost of 1 bin (100 lts)- INR 1,600/- (one time)
Cost of 15 bin (50 lts)- INR 24,000/- (one time)
Total- INR 24,000 /-
Third party waste hauler- **INR 50,000/month** (recurring)
Approximate revenue generated per year by selling dry waste- **INR 70,460/-**

Timeline

The strategy should be implemented in phases where the bins are purchased in phase one, along with the 3rd party waste hauler. Waste sensors can be added in phase 2, so that users will be adequately informed of the segregation by then.

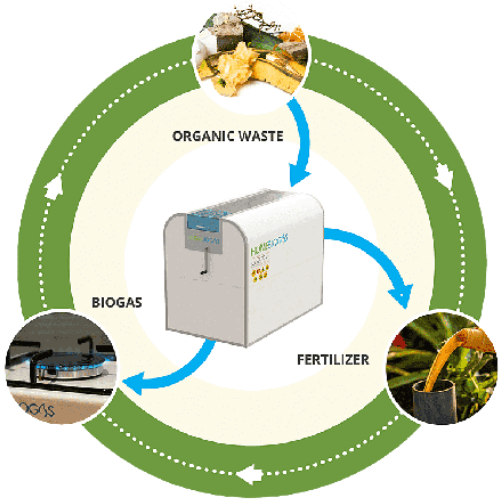
Disclaimer- the waste hauler cost and revenue generated by selling waste is a tentative amount. The cost may be change based on the waste hauler hired and the amount of waste generated in the campus.

Strategies : **Waste**

SOURCE-
https://www.amazon.in/Nilkamal-AIR-MATIC-Plastic-Wastebin/dp/B08KP22PFG/ref=sr_1_1_sspa?adgrpid=57946502054&ext_vrnc=hi&gclid=CjwKCAjwkaSaBhA4EiwALBgQaMaNvruc7nt8xcUgKsNYpGeXyhfVr4ORGAiMmYpBub43CVuaM1G9UBoCsf0QAvD_BwE&hvadid=381526451458&hvdev=c&hvlocphy=1007768&hvnetw=g&hvqmt=b&hvrand=37361489966701756l5&hvtargid=kwd-688298438778&hydadcr=6503_1957732&keywords=dustbin+100+ltr&qid=1665733372&qu=eyJxc2MiOiIzLjc3IiwicXNhIjoiMy4wNSIsInFzcCI6IjAuMDAifQ%3D%3D&sr=8-1-spons&psc=1

Strategy 2: Organic Waste to Biogas

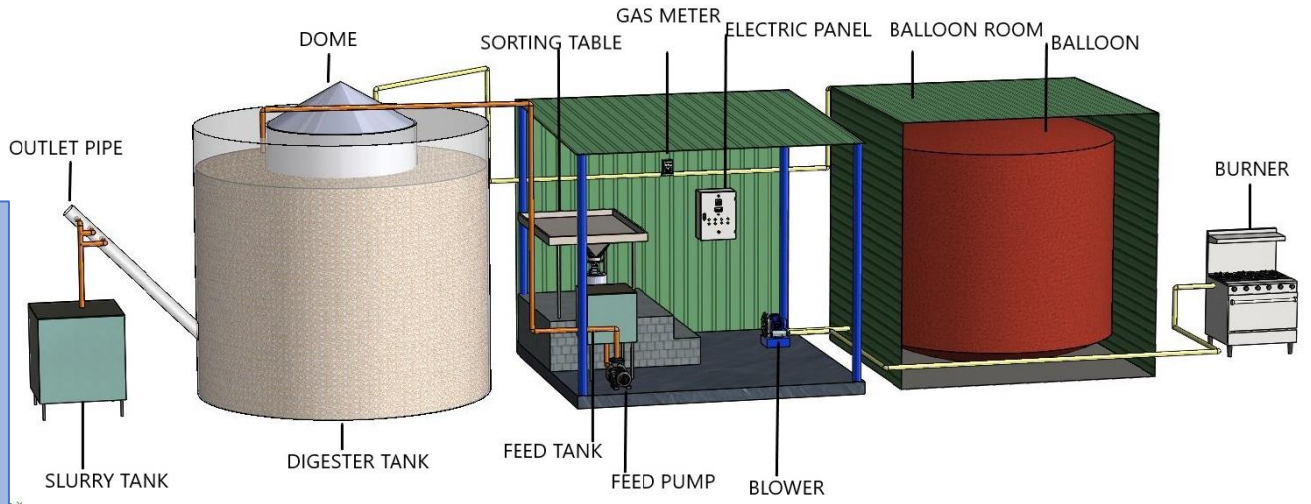
Biodigesters break down organic material such as food waste, agricultural residues, and animal and human manure into biogas, which can then be used for heating, cooking, transportation, and other uses.



To implement this strategy, we need following-

- **Organic waste segregation bin** in appropriate locations.
- **Staff** to feed the waste and run the machine.
- A **Bio-gas plant** that can convert the organic waste into biogas that can be used for cooking.
- **Quantitate data** (measuring and recording the waste collected + maintaining the bio-gas generated)

Organic waste comprises food, green material, landscape and pruning wastes, organic textiles and carpets, lumber, wood, paper products, printing and writing paper, manure, biosolids, and sludges.



Strategies : **Waste**

Implementation Steps

Step 1- Install organic waste collection bins in appropriate locations all over the campus

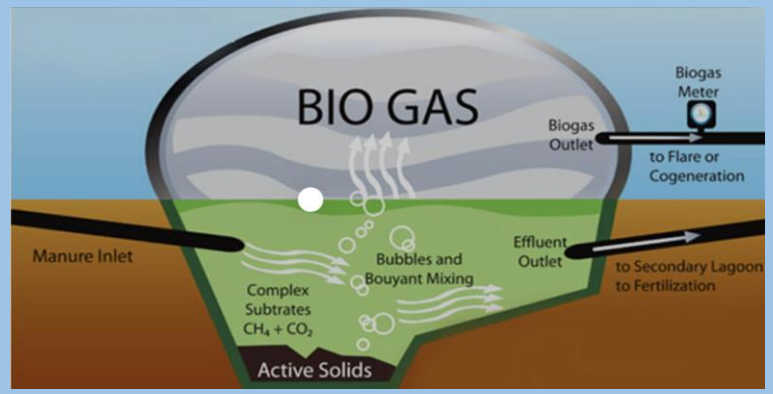
Step 2- Invest in a biogas plant on site and look for a secluded area so that noise doesn't bother anyone. Once the organic waste has been inserted into the machine, it is converted into a gas, which can be used for cooking reducing usage of gas cylinders. Waste is processed by compost machines into usable gas within 15 days.

Step 3- Hire and Educate- Hire a staff of 2 persons and educate them on running the plant and its details.

Step 4- Maintenance and Storage - Make sure the by product manure is stored and handled with care. Store it under dry conditions, so that it can be used properly as required. It is important that there are always Routine operations for predigester and digester tanks

Bio-Gas Plant Details

- **Technology Provider-** 'NISARGUNA' BARC technology
- **Plant Capacity-** 300kg/day
- **Biogas Quantity Generated-** (18-24) CUM of biogas daily, equivalent to (8-10.5)kg LPG, annually contributing to generating about (2.9-3.8) tonnes of LPG equivalent renewable energy. This helps in reducing approximately (73-96)tonnes of carbon -di-oxide annually.



Cost Estimations

Cost of Biogas Plant- INR. 1,00,000 (one time)
Cost of staff(2)- INR 24,000 (recurring)
Total- INR 1,24,000

Approximate revenue generated is INR 6,000/- per megaton. **(1MT= INR 6,000)**

Timeline

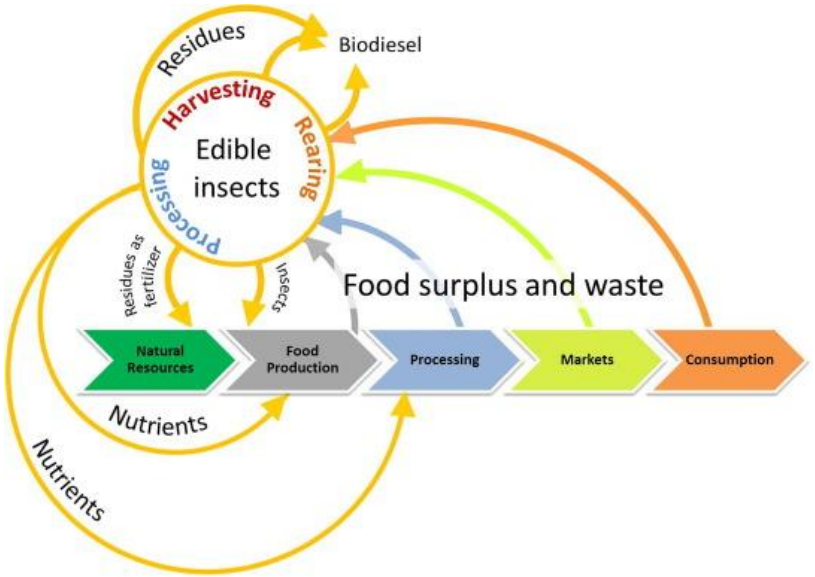
This strategy can be implemented in the scope 1 as the installation and running of the bio-gas is quite simple. The organic waste can be used as a renewable source immediately.

Disclaimer- the waste hauler cost and revenue generated by selling waste is a tentative amount. The cost may be change based on the waste hauler hired and the amount of waste generated in the campus.

Strategy 3: Circular Food System For The Campus

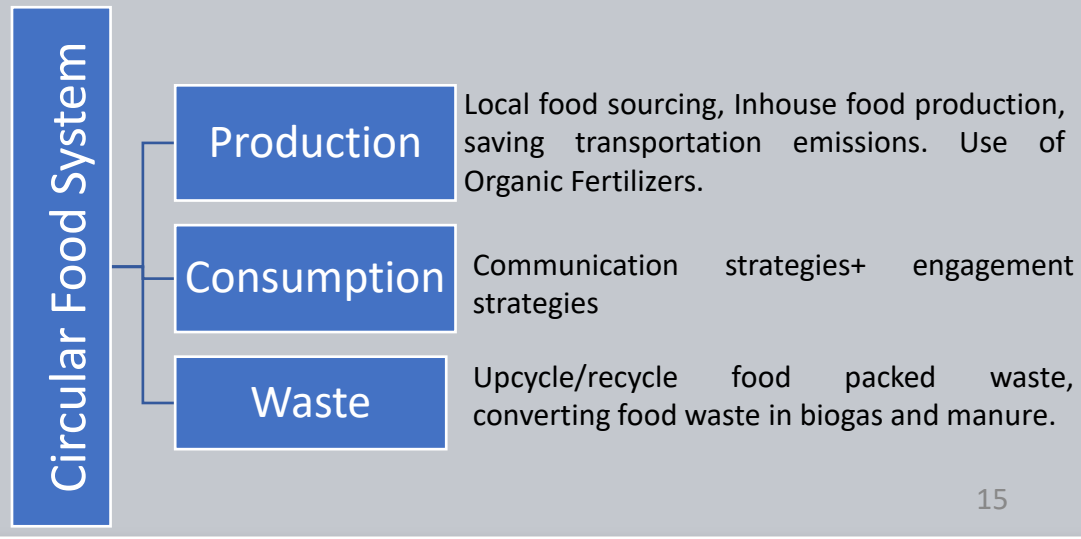
Currently, the regularly consumed fruits, vegetables, grains, cereals, dairy, and bakery products are bought from supermarkets or mandis without considering how much waste they generate (packing, emissions). It is called the Linear Food System. As part of the proposed circular food system, in any product or food or vegetable the entire life cycle from its production to its disposal is considered.

In a circular food system, regenerative production is prioritized, reuse and sharing are encouraged, resource inputs and pollution are minimized, and resource recovery is assured. Thus, they close resource loops and seek cross-sector synergies (e.g. with water and energy systems) to enhance a university's resilience.



To implement this strategy, we need following-

- **Tracking food cycle-** Understanding the contexts and needs of the consumers, as well as identify gaps and challenges that exist across the food chain.
- **Setting up- I**n house food production or sustainable and local sourcing of food (mandating a distance , for instance within 10 kms).
- **Logistics-** Understanding the routes used to transport food to the campus and the use of fossil fuel-powered cars?
- **Food Contractors-** The kitchen staff can share their weekly requirements with local farmers and understand seasonal crops and rotation of crops for menu planning.
- **Advanced Food system-** Smart food processing and waste.
  Organic fertilizer- Mandate the use of only organic fertilizer.



Strategies : **Waste**

Implementation Steps

Step1- Analyse Existing Food System-

Analyze the current food system, from food production to its waste.

Step 2- Design Circular Food System-

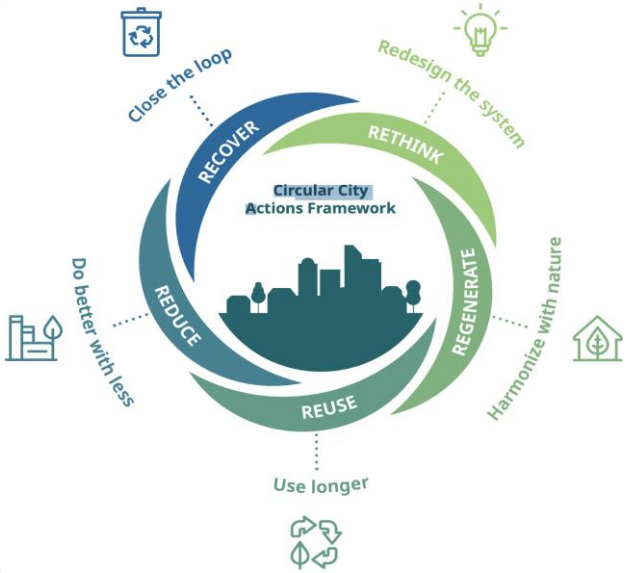
- *Rethink*

encourage re-usable water bottles by creating infrastructure for water re-fill stations. Facilitate synergies among water, energy and food systems.

- *Regenerate*
  1. Sustainable and local sourcing of Food- The raw and processed food needed should be within a range of 10 kms to control the transportation emissions. When food is produced locally,. there is direct access to the farmers. This way, we can ascertain what is the wastage on the farm, what chemicals are used, and what is the seasonality. These will help improve regenerative food production.
  2. In house food production- Identifying places on the University's campus where food can be grown. For instance, agroforestry practices can be used in the periphery of the campus. Green house food production is also recommended.

- *Reuse*

Utilize existing products, infrastructure and resources.



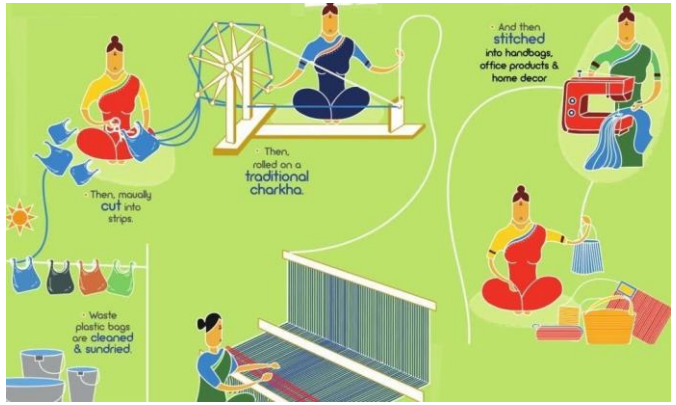
- *Reduce*

Talk to near-by bakery and dairy vendors for returnable packaging. Local sourcing of food will also avoid farm wastes. During consumption of food by students and visitors identify ways to reduce waste. One idea is to redesign serving spoons and educate students to take multiple refills instead of a plate full. The other idea is to place weighing scales underneath food waste bins located in the dining halls. This way students realize how much they are dumping food. Every day the previous day's kilogram reading of the waste can be put up on a board next to the food bin.

Strategies : **Waste**

- *Recover*

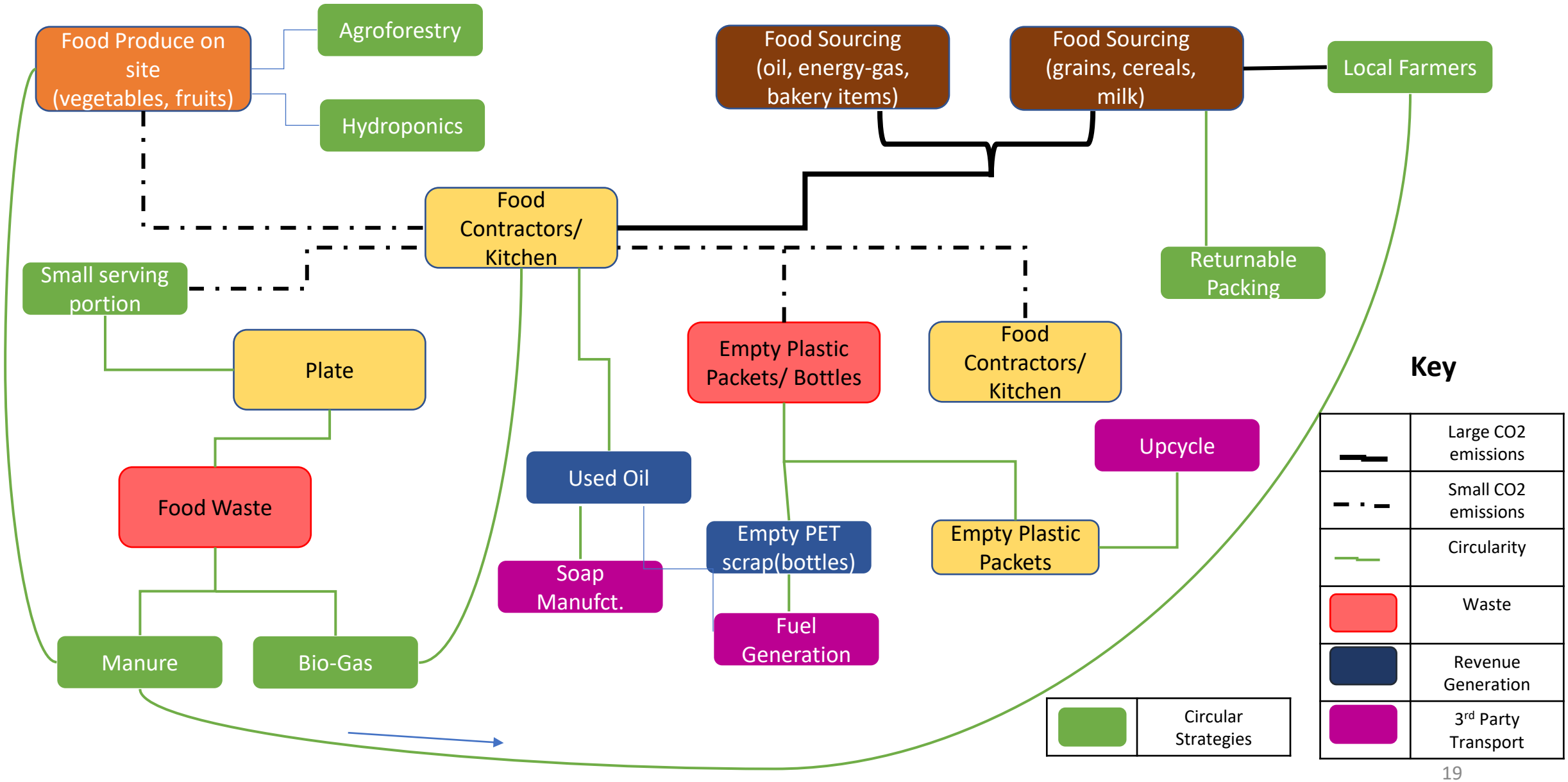
Recovery of food waste at the end of its life and facilitation of its re-introduction into production processes as compost, biogas. All the packaging waste, for instance milk pouches must be washed and kept separately, plastic wrapping packets should be washed and kept separately. The university can further send them to NGO's like Ecokarri, Rechakra who upcycle these into usable products ; thereby reducing the waste going to landfill. Similarly, every PET water bottle used on the entire University campus must be collected and stored separately. These can then be sent to a pyrolysis facility for converting into fuel. All the used oil from each of the contractors should be collected in one place. This oil can then be sold to local soap manufacturers for biodiesel units that used cooking oil as a raw material.



Approaches to make the Food System Circular

- Yellow boxes depict suggested ideas for circularity
- Green boxes depict the activity which can lead to circularity
- Dotted green arrows show the component of circularity
- Dark blue boxes are possible solutions that need to be explored further

Strategies : **Waste**



Strategies : **Waste**

Step3- Educate -
It is imperative to educate all the food contractors (kitchen staff, supply chain management) so that everyone is on the same page and the circular food system can be easily implemented.

Step 4- **Monitoring and execution system-**
This circular food system would require a lot of resources, co-ordination amongst different managements, students and staff. It is better to set up a monitoring team initially which can guide and review the steps every few weeks and intervene when necessary.

Timeline

The strategy needs to be implemented in phases; strategies such as local sourcing, reusable bottles, and returnable packaging for dairy and bakery items can be implemented in Phase 1.
Others, such as greenhouse production for food, can be implemented in Phase 2. As time passes, users will become comfortable with the new system, and soon it will become an integral part of teaching and learning.

Initial Cost Estimation

Strategies like local food sourcing, can be implemented at no cost.

Cost of planting trees for Agroforestry- INR 1,56,000
Cost of staff - -INR 1,20,000
Cost of constructing Hydroponics -INR 2,600 to 3,500/m2

Approximate revenue generated per kg by selling used oil and PET scrap 80 **Rs/k**

SOURCE-
Hydroponics- https://www.agrifarming.in/hydroponic-farming-in-bangalore-how-to-start-setup-cost-companies-and-suppliers

MANIPAL UNIVERSITY JAIPUR

Manipal University Jaipur's Energy Efficiency Plan

Manipal University Jaipur has taken a proactive stance by implementing a comprehensive energy efficiency plan aimed at significantly reducing its overall energy consumption. Energy efficiency is a critical component of any sustainable campus strategy. Manipal University Jaipur, a beacon of educational excellence, has embraced the challenge of reducing its environmental impact. The university's energy efficiency plan is a testament to its commitment to environmental stewardship and responsible resource management.

Energy Efficiency Plan

Energy Audits and Assessment

The first step in Manipal University Jaipur's energy efficiency journey is conducting comprehensive energy audits across campus. These audits analyze energy consumption patterns in buildings, equipment, and transportation, providing valuable insights into where improvements could be made.

Building Retrofits and Upgrades

Armed with data from the energy audits, Manipal University Jaipur initiates a series of building retrofits and upgrades. This includes improving insulation, installing energy-efficient lighting systems, and upgrading HVAC systems to modern, energy-efficient models

Renewable Energy Integration

To further reduce its reliance on fossil fuels, Manipal University Jaipur integrates renewable energy sources into its campus infrastructure. Solar panels have been installed to generate clean energy, reducing both energy costs and carbon emissions.

Smart Building Technologies

Manipal University Jaipur is at the forefront of adopting smart building technologies that optimize energy usage in real-time. Advanced building management systems monitor energy consumption and make immediate adjustments to minimize waste, further increasing overall efficiency.

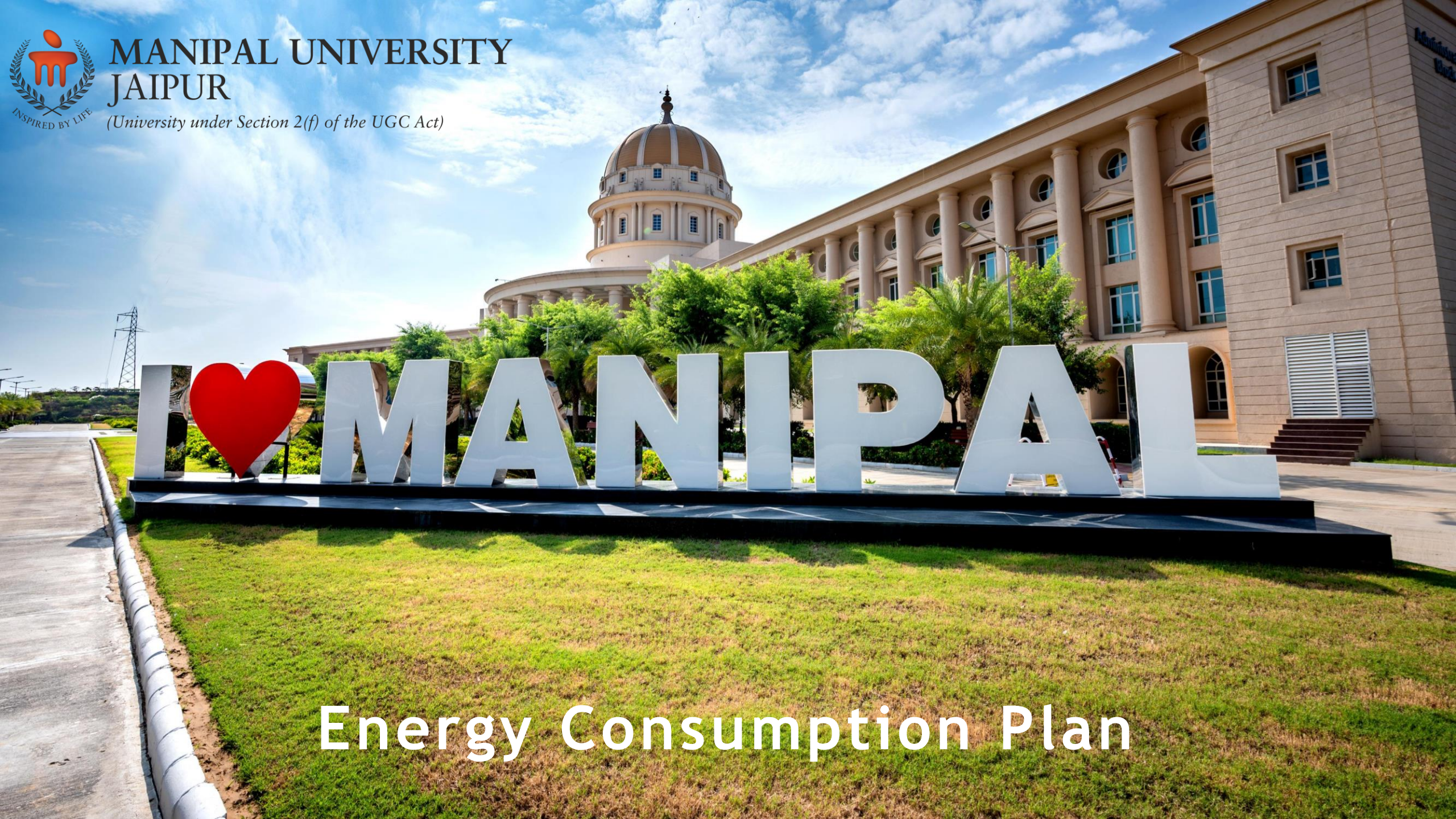
MANIPAL UNIVERSITY
JAIPUR

Sustainable Transportation

Recognizing the impact of transportation on its carbon footprint, Manipal University Jaipur prioritizes sustainable transportation options. It expanded public transportation access, added bike lanes, and promoted carpooling among students, faculty, and staff.

Manipal University Jaipur's initiatives inspire students to become future environmental leaders, and its research contributes valuable insights to the field of energy efficiency and sustainability.

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)



Energy Consumption Plan

MUJ Infra Ariel view

Solar Panels on MUJ roof

Board Rooms

Board Rooms

RENEWABLE ENERGY SOURCES

ENERGY AUDIT

INVENTUM POWER

Document ID: IPPL/EA/ND/19-20/01

ENERGY SAVING SUMMARY

S.No	Energy Conservation Projects	Annual Water Saving (KL)	Annual Energy Saving (KVAh)	Annual Monetary Saving in Lakhs	Investment (in lakhs) Rs.	Payback Period in Months	Co2 Emission Reduction in Ton	Page No
1	Avoiding use of transformer-1 during non-peak months		21,818	2.05	1.5	9	17.9	54
2	Maintaining 410-415 V instead of 430 V at Transformer-1		1,40,695	13.23	Nil	Immediate	115.4	55
3	Energy saving achieved by Chiller set point optimisation		13,745	1.29	Nil	Immediate	11.3	57
4	Energy saving by chiller plant optimisation		43,636	4.10	Nil	Immediate	35.8	59
5	Installation of Automation in Unitary AC		7,987.2	0.75	1.2	19	6.5	63
6	Replacement of Old AC by Inverter AC		3,840	0.36	1.2	40	3.1	63
7	Increase Re-use of Grey-Waste Water from laundry	4000		9.76	15.0	18	-	68
8	Energy saving by using fine bubble diffuser		44,460.6	4.26	5.0	14.2	36.5	71
9	Aggregation and optimisation of compressed air usage in STP		3,625.3	0.34	0.5	17.8	3.0	74
10	Installation of Energy efficient fans		2,40,000	22.56	90.0	48	196.8	79
11	Replacement of Inefficient Heat Pumps (Either by new heat pump or through staform hot water system)		49,332.8	5.1	7.8	18.5	40.5	81
12	Cleaning and Maintenance of Heat pumps to improve COP		39,926.3	3.8	6.0	19.2	32.7	83
13	Installation of Solar street light at peripheral roads		24,741.8	2.3	9.5	48.8	20.3	85
Total		**4000**	**6,33,809**	**70**	**138**	**24**	**520**	

Energy Audit Report

RENEWABLE ENERGY UTLIZATION AT MANIPAL UNIVERSITY JAIPUR

Renewable energy Utilization is a key part of the design and development at Manipal University Jaipur. Hence, on site energy generation was given precedence to offset at least 50% of the total energy demand to achieve this solar p.v arrays are installed on the rooftops across all the major buildings in the University.

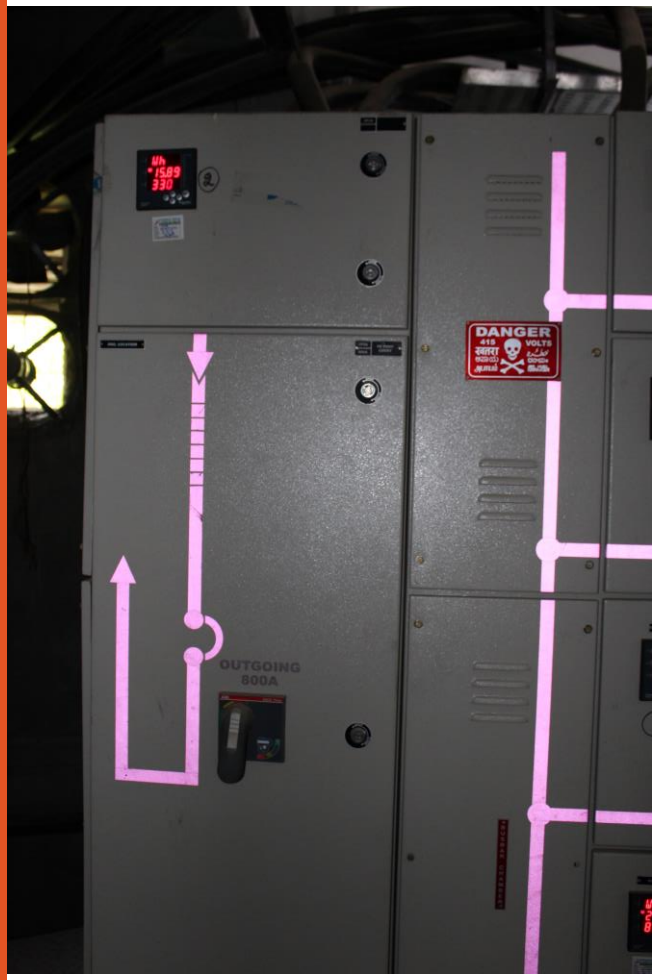
Key Performance Indicators:

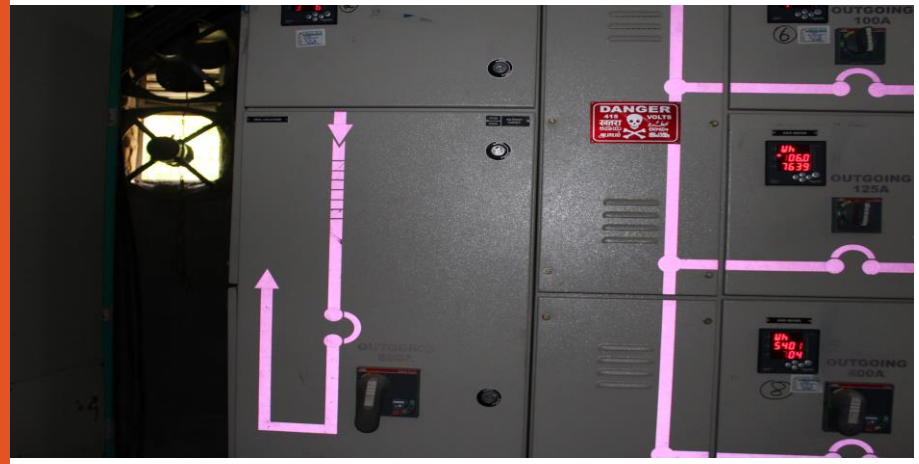
The approach of MUJ to race towards self sufficiency in Energy is by reducing overall energy demand of MUJ (Admin & Academic-1) wherever possible. Design optimization was the key aspect which is driving MUJ to achieve energy use reduction. The reduced energy will be met by on site generated solar energy

- Climate responsive design of the building is the key element in the reduced energy demands.
- Appropriately sized systems with energy efficient technology & controls further reduced the energy demands
- Design has considered the orientation of building to construct the service structures on roof to reduce the amount of self shading & shadow patches on roof to maximum energy harvest with the solar pv's.
- Constant increase in capacity of solar PV system to steady offset of conventional energy demands

➢ Usage Details Report (click here)

RESOURCE CONSUMPTION MONITORING





ENERGY AUDIT REPORT

Manipal University, Dehmi Kalan, Jaipur,

303007

Conducted by

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DOCUMENT CONTROL:

Document Title	**Detailed Energy Audit of New door hostel, Jaipur Rajasthan**
Reviewed and Approved By	Vivek Zaveri BEE certified energy auditor JK Sharma Head- Technical, Energy Audit Md. Shahrukh Khan Head- Business Development
Prepared By	Md. Tariq Senior Executive Vishal Venkatesh Senior Executive Brij Kishor Executive Abhishek Kumar Executive

Sr. No	**Document Identification**	**Revision**		**Comments**
		No	**Date**	
1	IPPL/EA/ND/19-20/00	00	27/11/19	Preparation of draft Report
2	IPPL/EA/ND/19-20/01	01	05/12/19	Incorporation of Reviewer's comments

DISCLAIMER

This report is based on the information provided by the management of **New Door, Jaipur** & on-site observations on specific dates. We certify that this information and following analysis is correct to the best of our knowledge and ability. The validity of the recommendations is dependent on the accuracy of log books and historical data supplied to us. This report (including any enclosures and attachments) has been prepared for the exclusive use and benefit of the addressee(s) and solely for the purpose for which it is provided. Unless we provide express prior written consent, no part of this report should be reproduced, distributed or communicated to any third party. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report. The recommendations and findings are to be used by client at their own accord and Inventum Power Private Limited or its associates would not be responsible for any material or non-material losses (if any) occurring in any way due to their implementation.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENT

INVENTUM POWER PVT. LTD. express our sincere thanks to the management of **"New Door"** for giving us the opportunity to conduct energy audit at their Facility and give our findings to them.

INVENTUM POWER PVT. LTD. acknowledges and appreciates the commitment of the management towards conservation of Energy. It needs to be stated here that the **NEW DOOR MANAGEMENT** has been very supportive and cooperative resulting in expeditious completion of the energy audit.

We hereby also express our thanks to all other staff for their support during field study & data collection. We hope that the recommendations/suggestions given in this report will help to reduce the present energy consumption of the Facility with reduced cost & improved productivity.

TEAM MEMBERS FROM ELIN ELECTRONICS UNIT

Mr Shahid Zamal	-Operations Head/Unit In charge
Mr Bharat Bhushan	- AGM
Mr Brij Mohan	-Deputy Manager
Mr Kunal	-Shift Engineer
Mr Hitesh	-Shift Engineer

TEAM MEMBERS FROM INVENTUM POWER PVT. LTD

Mr Vivek Zaveri	-	Senior Energy Auditor
Mr Md Tariq	-	Senior Executive
Mr Vishal Venkatesh	-	Senior Executive
Mr Brij Bhadoriya	-	Executive
Mr. Abhishek Kumar	-	Executive

EXECUTIVE SUMMARY

Energy is one of the major inputs in any industry and is the mainstay of the economic development of the country. Rising Electricity & fuel costs coupled with increased global competition is forcing players to slash the energy costs. Energy Audit helps in energy cost optimization, pollution control, safety aspects and suggests the methods to improve the operating & maintenance practices of the system. It is instrumental in coping with the situation of variation in energy cost availability, reliability of energy supply, decision on appropriate energy mix, decision on using improved energy conservation equipment's, instrumentation's and technology.

The total expenditure in Electrical energy cost is about **9.19 Crore from February 18 to January 19 & total water cost of 80.63 lakhs from Jan-19 to Oct-19 and.** It was aimed at obtaining a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy savings opportunities.

Energy conservation is a continuous process and there is always scope for further improvements, with this objective the Energy Audit team with the active involvement of **New door** have identified the following Energy Conservation Opportunities (ECO's). Implementation of the ECO's can further help reduce the energy consumption.

Total Saving potential is 7.5% in Electrical and 12.3% in water of the total energy Cost, accordingly we have enumerated the energy savings measures with reference to their payback periods. However, few measures are with larger payback periods but then there are certain initiatives which are necessary from modernization, energy conservation & corporate social responsibility point of view.

To review the reasons for excess energy consumption and Measures undertaken to improve Energy Efficiency, the following table would be helpful.

ENERGY SAVING SUMMARY

S.No	Energy Conservation Projects	Annual Water Saving (KL)	Annual Energy Saving (KVAh)	Annual Monetary Saving in Lakhs	Investment (in lakhs) Rs.	Payback Period in Months	Co2 Emission Reduction in Ton	Page No
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Total		**4000**	**6,33,809**	**70**	**138**	**24**	**520**	

1. ENERGY CONSERVATION PRACTISES BY NEW DOOR

We would like to appreciate and admire various good energy practices by New Door engineering team which are as follows:

1. Use of renewable energy like Solar water heater and SPV in the premises.
2. Tighter control of chiller operations avoiding unnecessary use of it.
3. Continuous awareness on energy and water conservation through rear announcement in corridors of each block that can be heard from inside the room.
4. Use of water savings aerator saving at least 2000kl per year.
5. Use of 6/4 toilet flush saving lot of water.
6. Use of regulating chilled water for first and last 15 minutes operation of chiller without using compressors saving lot of energy.
7. Use of LED lights for roads and garden light.
8. Highly proactive maintenance of heat pumps due to which at least 50%of them are working.
9. Use of STP treated water in gardening reducing the requirement of fresh water.
10. Downstream energy metering as a good energy management system.
11. Use of **RAIN WATER STORAGE** system.

2. INTRODUCTION

2.1 OBJECTIVE OF ENERGY AUDIT:

Energy audit is the key to a systematic approach for decision-making in the area of energy management and gives a positive orientation to the energy resource cost reduction. The primary objective of the energy audit is to determine ways to reduce energy consumption to lower operating costs.

The Energy audit is conducted with the following Objectives:

- Detailed studies of the intended energy consuming equipment including historical and present energy performance trends
- Quantification of Energy Losses, and Energy Saving Potential
- Presentations of Energy Efficiency Measures with cost benefit analysis
- Identifying potential areas of electrical energy economy.

This energy audit assumes significance due to the fact that the New door**, total Electricity bill crossed 9.19 Crore from Feb'18 to Jan'19 & total water cost of 80.63 lakhs from Jan-19 to Oct-19** and it was aimed at obtaining a detailed idea about the various end use energy consumption activities and identifying, enumerating and evaluating the possible energy savings opportunities.

2.2 ABOUT NEW DOOR:

The door to the new era is opened by young people. A steady stream of young talent is essential for the development of societies and nations. At Good Host Spaces, we take great pleasure in fostering the youth, with our new door tech forward houses. When they set out to open doors for embracing new opportunities, in new cities, we offer them a dynamic living experience. Making their belief stronger in the magic of new beginnings.

2.3 ABOUT AUDIT TEAM MEMBERS:

We have dedicated and expert team for services. Your first point of contact with Inventum Power care will be with our dedicated customer services team. We are highly skilled, motivated and fully trained to assist you. Our services team includes our expert, highly experienced advisors for power factor correction systems, harmonic filter and others Energy and Power Quality problems who have over 40 years combined experience for the same. Each team member is dedicated to offering a high level of customer care and also strives for excellence to ensure that you receive the perfect service.

2.4 SCOPE OF ENERGY AUDIT WORK:

Electrical Distribution System:

- Study of Reactive Power Management and option for power factor improvement.
- Study of power quality issues like Power Factors, Voltages, Currents, Active Powers, Reactive Powers, Apparent Powers, THD & Harmonics at various load feeders.
- Capacitor bank health check-up
- Exploring the Energy Conservation Options (ENCON) in electrical distribution system to optimize transformer loading & improvement in level metering.
- Exploring the solutions for improving the power quality.

HVAC System

- Review the performance of the refrigeration & air conditioning systems including AHU, Chillers, Cooling tower, Air conditioners, find out Energy Efficiency Ratio, kW/TR, Specific TR loading and Kwh Calculation, available TR in the area through measuring velocity of air flow & temp. & humidity requirement as per existing & the proposed recommendation to suggest energy conservations means to improve the same.
- Collection of Inventory data of Air conditioners / Sample size selection and testing of power consumption and capacity (TR) delivered under the existing weather conditions / Air-conditioned floor area.

Pumps & Motors

- Performance assessment of HVAC pumps via Head/pressure, flow, power and determination of pump/motor loading based on measured parameters.
- Exploring the Energy Conservation Options (ENCON) in water pumping system. All saving & recommendation.

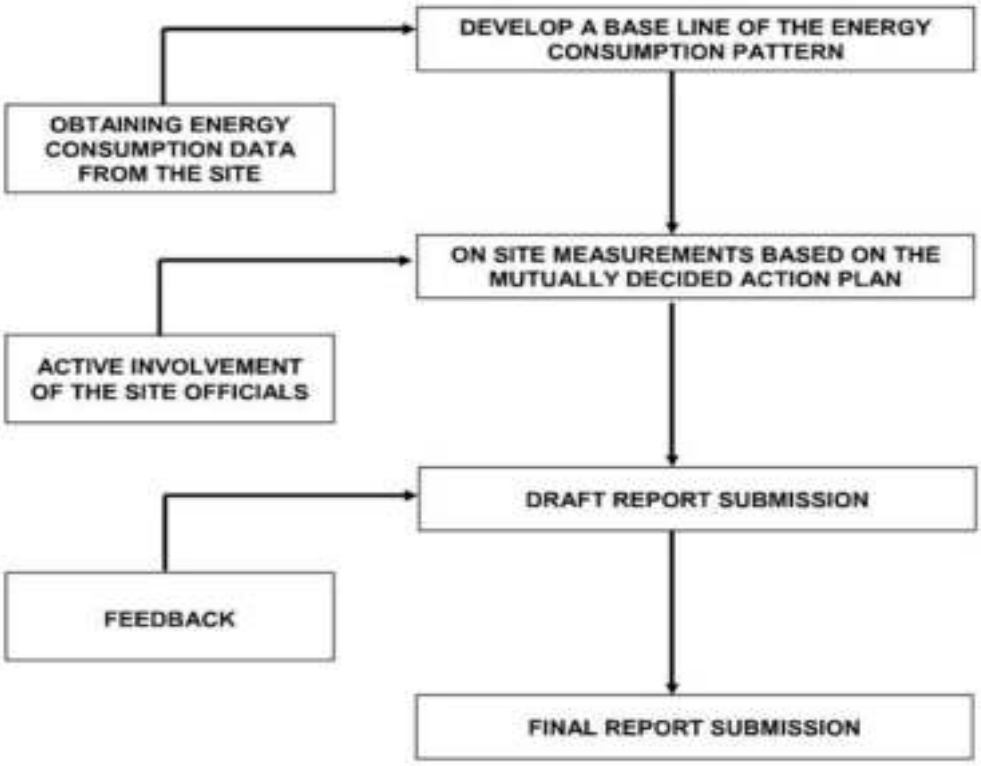
DG Sets:

- Review of the operation and performance of DG set through units generated, diesel consumption
- Specific fuel consumption in terms of KWh/Ltr and suggest for energy conservation opportunity.

2.5 METHODOLOGY OF WORK:

The methodology adopted for this audit was

- A preliminary energy audit has been conducted to establish the energy consumption of the organization by analyzing the available past energy consumption data, identification of the areas requiring more detailed study and measurements.
- Visual inspection and data collection.
- Identification/verification of energy consumption and other parameters by measurements.
- Computation and in-depth analysis of the collected data, including utilization of computerized analysis and other techniques as appropriate were done to draw inferences and to evolve suitable energy conservation plan/s for improvements/ reduction in specific energy consumption.
- Potential energy saving opportunities
- Flow Chart for Methodology for report preparation



This report is just first step, a mere mile marker towards our destination of achieving energy efficiency and we would like to emphasize that an energy audit is a continuous process. We have compiled a list of possible actions to conserve and efficiently utilize our scarce resources and identified their savings potential.

2.6 LIST OF INSTRUMENTS

- 3 Phase Power Analyzer-Fluke 1736
- BlackBox-G3500
- Power Clamp
- Distance Meter
- Anemometer
- Hygrometer
- Thermal Camera

Figure 1: Energy Audit Instruments

3. GENERAL INFORMATION ABOUT UNIT

3.1 GENERAL DETAILS:

Name & Address of the Unit	New Door, Jaipur
Operational Days	300 Days per annum
Contact Officer	Mr Bharat Bushan
Electricity Connection Details & Consumption	
Connection Type	HT 33000/11000/415 V
Contract demand	4000kW
Average Max. Demand (Feb 18 to Jan'19)	2576
Annual Energy Purchased (Feb 18 to Jan'19)	11,724,600
Annual Energy Purchased Cost (Feb 18 to Jan'19)	9.19 Crore

Table 1: General details of the unit

3.2 ASSUMPTIONS:

For calculation purpose, we have considered following:

Type of Energy Resources	UOM	Value
No. of operating hrs in a day	hours	24
Avg. Electric Rate	Rs. /kVAh	9.4
Avg Water Rate	Rs./KL	246

Table 2: Assumption for calculation

3.3 % SHARE IN ENERGY CONSUMPTION

Percentage Share of Equipment	Energy consumption (KWh)	% Usage
HVAC	3647536	32.3%
Lighting & Fan	4732166	41.9%
STP & WTP	542948	4.8%
Hot water System	1280000	11.3%
Misc. (T&D Losses)	1095923	9.7%

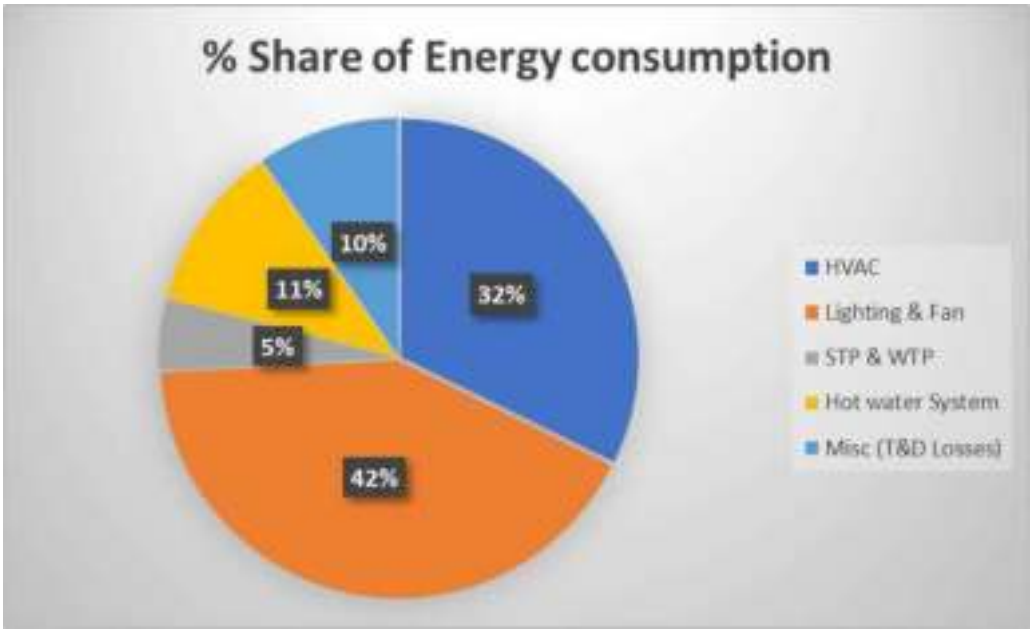


Figure 2: % Share in Energy consumption in different area

4. ELECTRICITY BILL ANALYSIS

4.1 MONTHLY KVAH CONSUMPTION TREND:

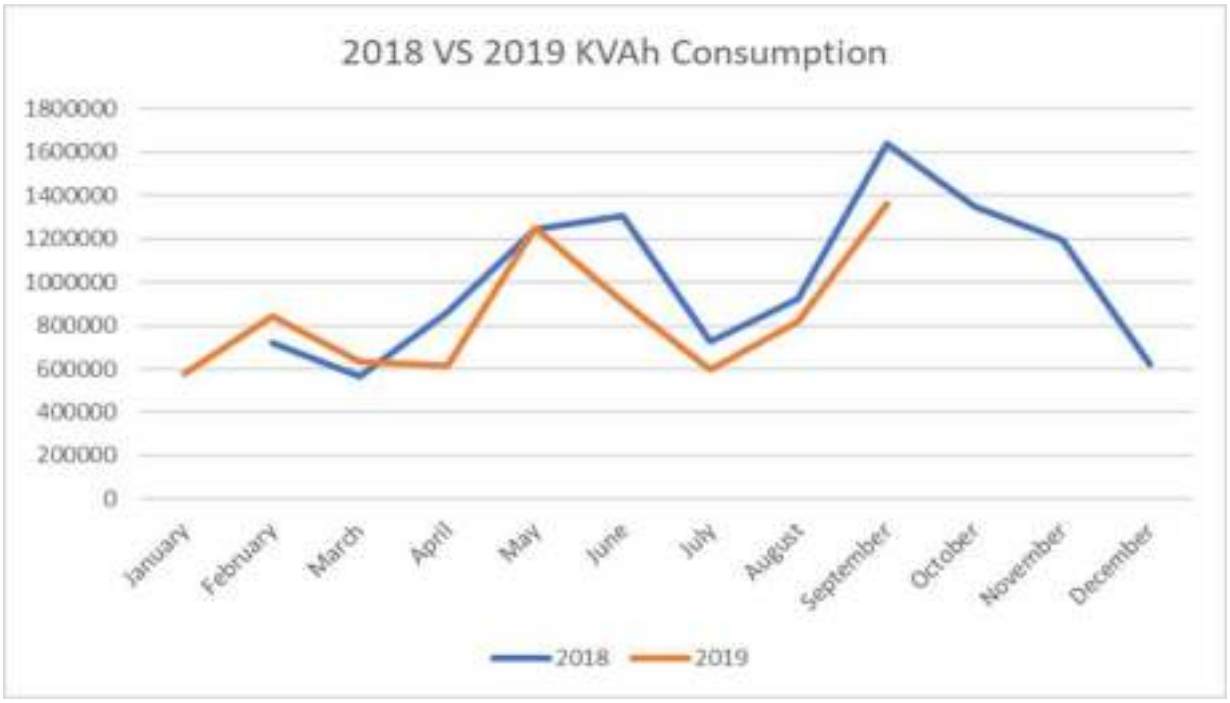


Figure 3: Monthly KVAh Trend

4.2 MONTHLY POWER FACTOR TREND:

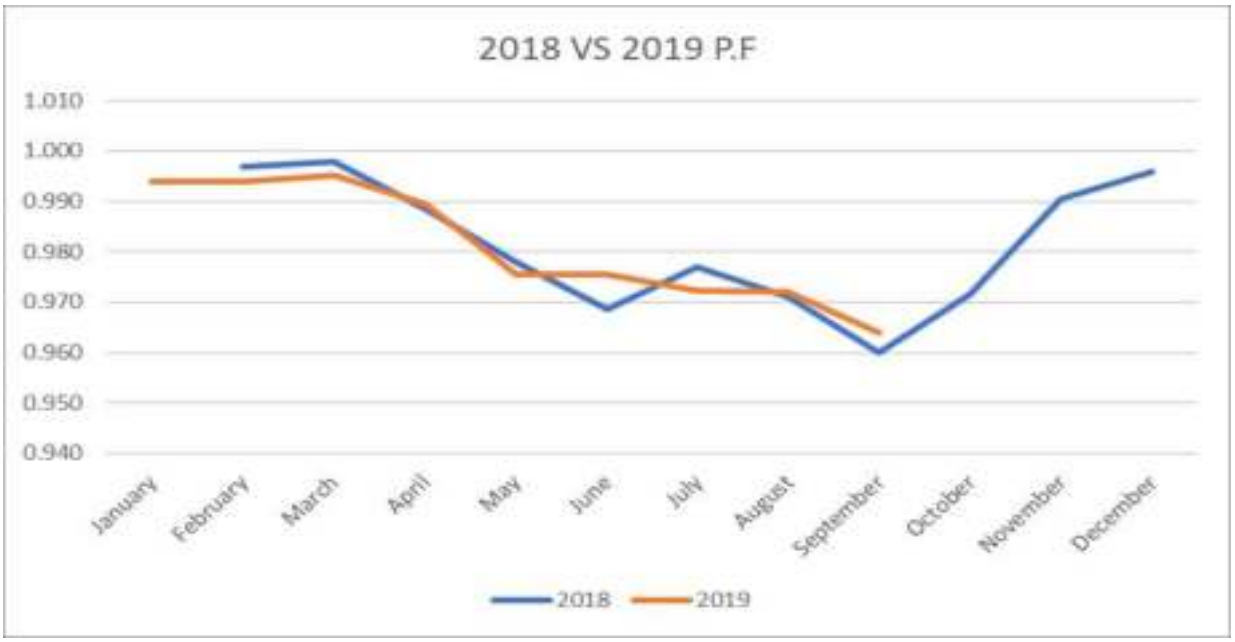


Figure 4: Monthly PF Trend

4.3 MONTHLY C.DEMAND V/S M.DEMAND TREND:

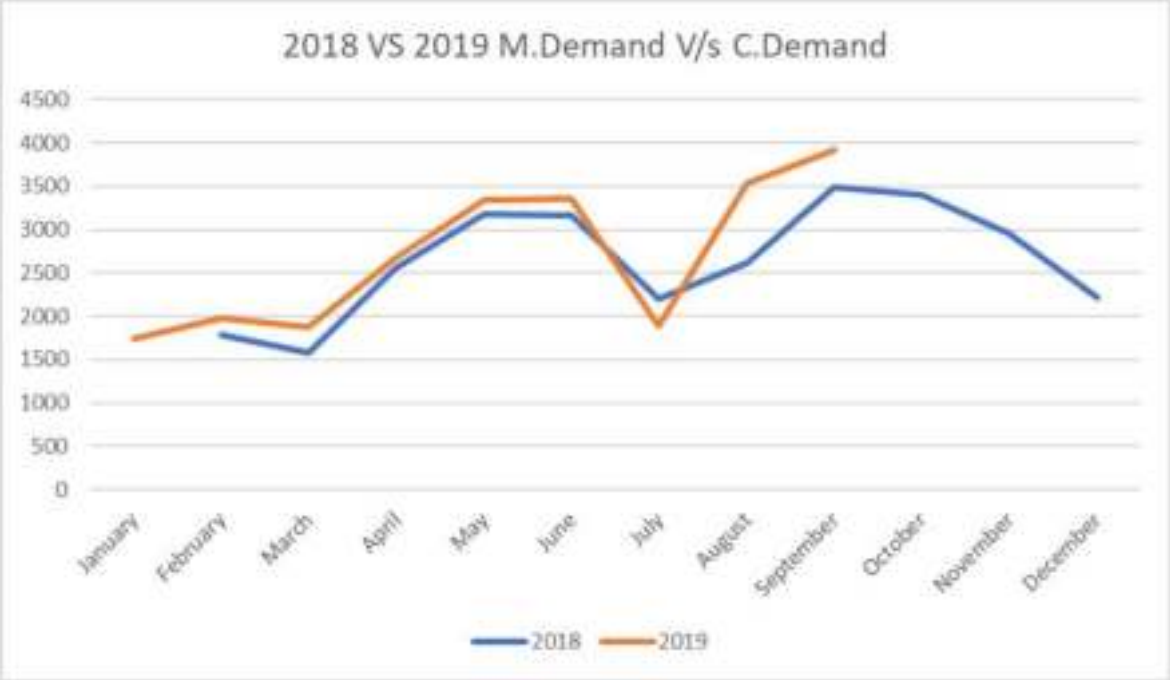


Figure 5: Monthly C. Demand VS M. Demand Trend

Sr no	Month	2018			2019		
		Maximum demand	KVAH	PF	Maximum demand	KVAH	PF
1	January	N. A	N. A	N. A	1746	579309	0.995
2	February	1788	721860	0.998	1980	543936	0.991
3	March	1578	567780	0.999	1872	631659	0.995
4	April	2556	859320	0.988	2670	613617	0.989
5	May	3180	1244040	0.978	3336	1250526	0.975
6	June	3168	1305048	0.969	3360	912564	0.976
7	July	2202	723312	0.978	1896	594477	0.972
8	August	2622	920940	0.971	3528	815805	0.973
9	September	3492	1636191	0.959	3924	1362039	0.964
10	October	3408	1346769	0.971	N. A	N. A	N. A
11	November	2952	1195887	0.991	N. A	N. A	N. A
12	December	2220	624144	0.997	N. A	N. A	N. A

Note: From electricity bill analysis we observed that P.F has decreased to 0.964 in the month of September. This may be due to Low Loading of the transformers.

4. PERFORMANCE ASSESSMENT AND ENERGY SAVING SCOPE

4.1 ELECTRICAL DISTRUBUTION SYSTEM:

4.1.1 POWER QUALITY STUDY OF TRASFORMERS:

At New door, 3 no's of Transformers are installed and the rated of the transformer are 3000 KVA, 2x1000 KVA. Our team connected 3 phase analysers at all 3 transformers and at Solar HT Side and Main HT panel for 24 hours to study their power quality parameters.

Figure 6: Name Plate details Transformers Installed at New Door

4.1.1.1 PQ SUMMARY OF POINTS IN NEW DOOR

1. HT Panel

Sr. No	Parameter	Unit	Avg. value R-Phase	Avg. value Y-Phase	Avg. value B-Phase	Total Value
1	Voltage (L-L)	kVolt	11.17	11.2	11.15	-
2	Average Current	Amp	44.2	43.7	43.3	-
3	Apparent power	kVA	281.15	279.09	285.76	846.01
4	Active power	kW	280.86	278.882	285.61	845.35
5	Reactive power	kVAr	7.67	-1.31	105.36	6.46
6	Power Factor		0.99	0.99	0.99	0.99
7	THD-V	%	0.87	0.94	0.74	-
8	THD-I	%	4.03	4.12	3.73	-

Table 3: PQ Summary of HT Panel

2. Solar Incomer

Sr. No	Parameter	Unit	Avg. value R-Phase	Avg. value Y-Phase	Avg. value B-Phase	Total Value
1	Voltage (L-L)	kVolt	11.23	11.26	11.22	-
2	Average Current	Amp	7.96	7.96	7.72	-
3	Apparent power	kVA	51.38	50.5	51.6	153.06
4	Active power	kW	48.8	48.07	48.75	145.66
5	Reactive power	kVAr	9.09	8.4	7.91	25.4
6	Power Factor		0.95	0.952	0.953	0.95
7	THD-V	%	1.5	1.45	1.41	-
8	THD-I	%	6.23	6.23	5.38	-

Table 4: PQ Summary of Solar Incomer

3. Transformer-I

Sr. No	Parameter	Unit	Avg. value R-Phase	Avg. value Y-Phase	Avg. value B-Phase	Total Value
1	Voltage (L-L)	kVolt	414	415.6	415.3	-
2	Average Current	Amp	301.9	284.4	304.8	-
3	Apparent power	kVA	68.98	70.62	73.5	213.18
4	Active power	kW	68.66	70	73.26	211.98
5	Reactive power	kVAr	-3.61	-7.97	-5.09	-16.63
6	Power Factor		0.995	0.991	0.996	0.994
7	THD-V	%	1.79	1.88	1.67	-
8	THD-I	%	8.82	8.39	6.37	-

Table 5:PQ Summary of Transformer-I

4.Transformer-II

Sr. No	Parameter	Unit	Avg. value R-Phase	Avg. value Y-Phase	Avg. value B-Phase	Total Value
1	Voltage (L-L)	kVolt	415.9	417.5	417.7	-
2	Average Current	Amp	478.8	450.87	443.48	-
3	Apparent power	kVA	110.66	107.59	112.02	330.28
4	Active power	kW	110.52	107.34	111.58	329.44
5	Reactive power	kVAr	-4.34	-6.89	-9.115	-20.36
6	Power Factor		0.999	0.998	0.996	0.997
7	THD-V	%	1.79	1.9	1.79	-
8	THD-I	%	4.86	5.45	3.71	-

Table 6:PQ Summary of Transformer-II

5.Transformer-III

Sr. No	Parameter	Unit	Avg. value R-Phase	Avg. value Y-Phase	Avg. value B-Phase	Total Value
1	Voltage (L-L)	kVolt	426.8	428.4	425	-
2	Average Current	Amp	487	416	431	-
3	Apparent power	kVA	111.2	104.8	111.8	327.9
4	Active power	kW	110.1	104.2	111.4	325.7
5	Reactive power	kVAr	12.95	6.56	3.76	23.52
6	Power Factor		0.99	0.99	0.99	0.99
7	THD-V	%	1.97	1.71	1.82	-
8	THD-I	%	7.03	8.14	5.53	-

Table 7:PQ Summary of Transformer-III

Observations:

HT Panel:

1. Voltage dip of 1KV FROM 11.2 KV to 10.2 KV is observed for 500ms in HT Panel which may be the replica of power quality at transformer-1.
2. Both THD V and THD I are within the range as per IEEE standard. IEEE standard is attached in the Annex. 1.
3. Others parameters of the Transformer are found okay.

Solar HT side:

1. Both THD V and THD I are within the range as per IEEE standard. IEEE standard is attached in the Annex. 1.
2. Ohers parameters of the Transformer are found okay.

Transformer 1:

1. Voltage Dip of 50 V from 415V to 365 is observed for 60 ms in Transformer-1.
2. Both THD V and THD I are within the range as per IEEE standard. IEEE standard is attached in the Annex. 1.
3. The average pf is captured 0.99.

Transformer 2:

1. Both THD V and THD I are within the range as per IEEE standard. IEEE standard is attached in the Annex. 1.
2. The average pf is captured 0.99.

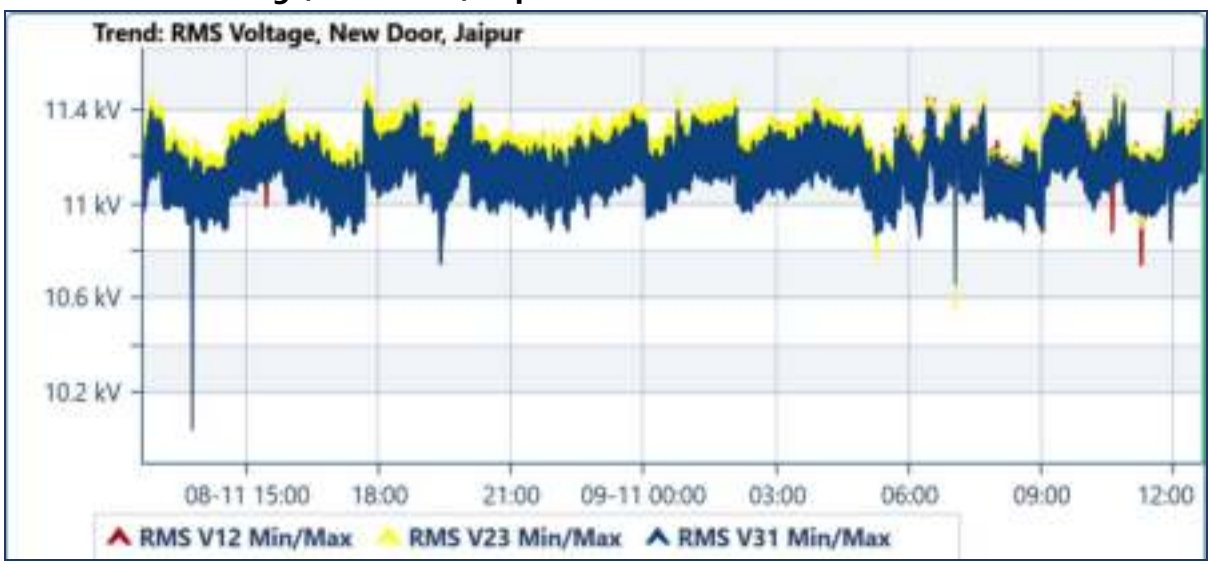
Transformer 3:

1. Both THD V and THD I are within the range as per IEEE standard. IEEE standard is attached in the Annex. 1.
2. The average pf is captured 0.99.

4.1.1.2 GRAPHICAL TRENDS OF PQ OF TRANSFORMERS:

1. HT Panel

Trend of RMS Voltage, New Door, Jaipur



Parameter	Min	Max	Average
RMS V12 (Auto)	10.041 kV	11.503 kV	11.179 kV
RMS V23 (Auto)	10.114 kV	11.512 kV	11.204 kV
RMS V31 (Auto)	10.042 kV	11.469 kV	11.153 kV

Trend of RMS Current, New Door, Jaipur

Parameter	Min	Max	Average
RMS I1 (Auto)	12.769 A	168.111 A	44.215 A
RMS I2 (Auto)	13.698 A	114.511 A	43.722 A
RMS I3 (Auto)	13.236 A	144.844 A	43.303 A

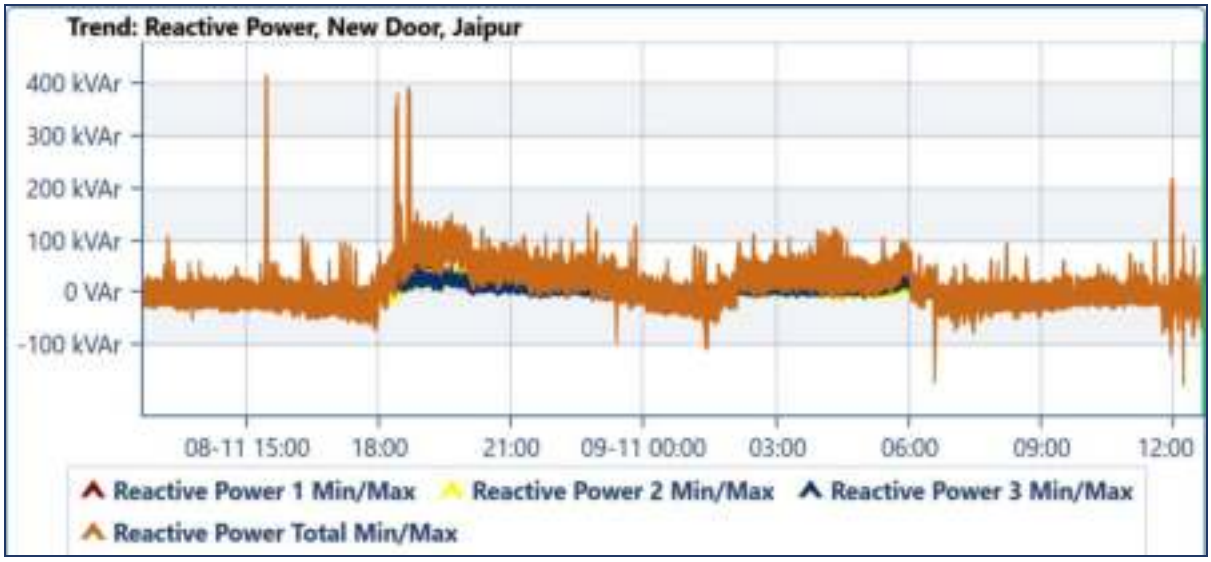
Trend of Apparent Power, New Door, Jaipur

Parameter	Min	Max	Average
Apparent Power 1 (Auto)	82.404 kVA	552.595 kVA	281.149 kVA
Apparent Power 2 (Auto)	83.2 kVA	545.624 kVA	279.099 kVA
Apparent Power 3 (Auto)	83.387 kVA	690.589 kVA	285.767 kVA
Apparent Power Total (Auto)	260.604 kVA	1.71 MVA	846.016 kVA

Trend of Active Power, New Door, Jaipur

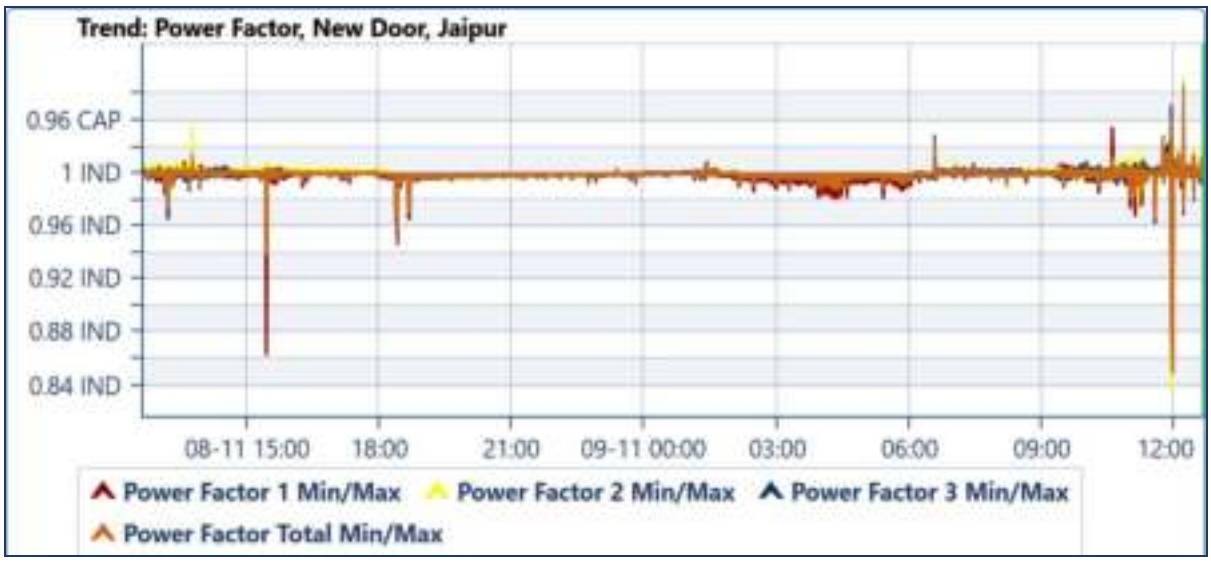
Parameter	Min	Max	Average
Active Power 1 (Auto)	79.517 kW	550.985 kW	280.862 kW
Active Power 2 (Auto)	82.875 kW	543.748 kW	278.882 kW
Active Power 3 (Auto)	83.333 kW	683.588 kW	285.61 kW
Active Power Total (Auto)	260.411 kW	1.65 MW	845.354 kW

Trend of Reactive Power, New Door, Jaipur



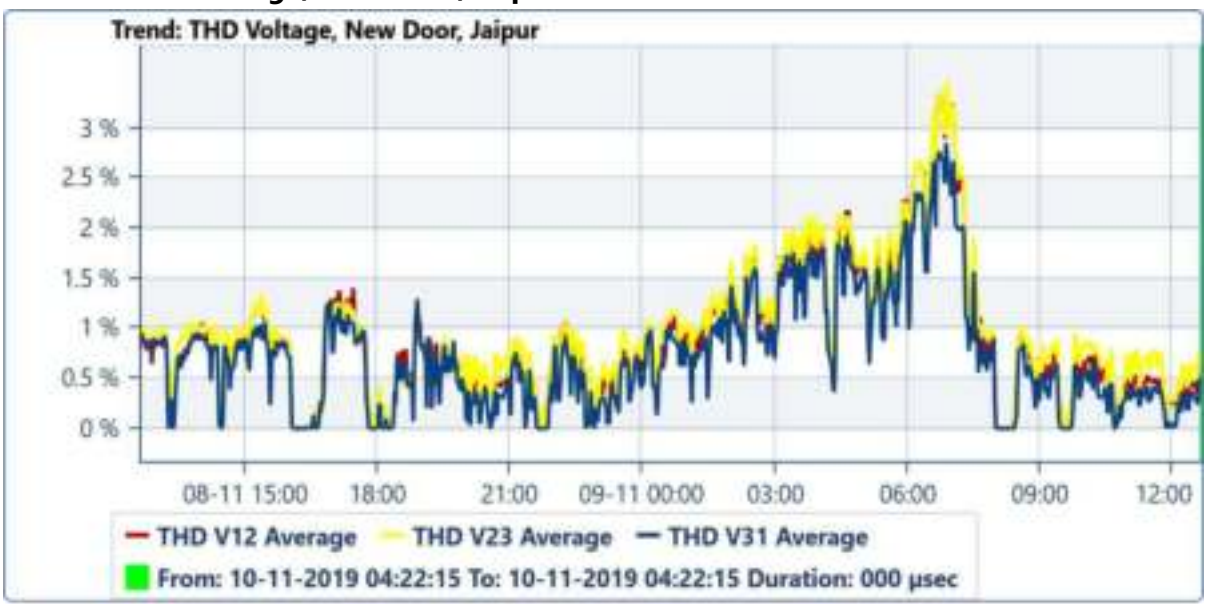
Parameter	Min	Max	Average
Reactive Power 1 (Auto)	-56.23 kVAr	258.03 kVAr	7.676 kVAr
Reactive Power 2 (Auto)	-61.589 kVAr	129.255 kVAr	-1.317 kVAr
Reactive Power 3 (Auto)	-65.942 kVAr	135.357 kVAr	105.369 VAr
Reactive Power Total (Auto)	-177.15 kVAr	419.167 kVAr	6.464 kVAr

Trend of Power Factor, New Door, Jaipur



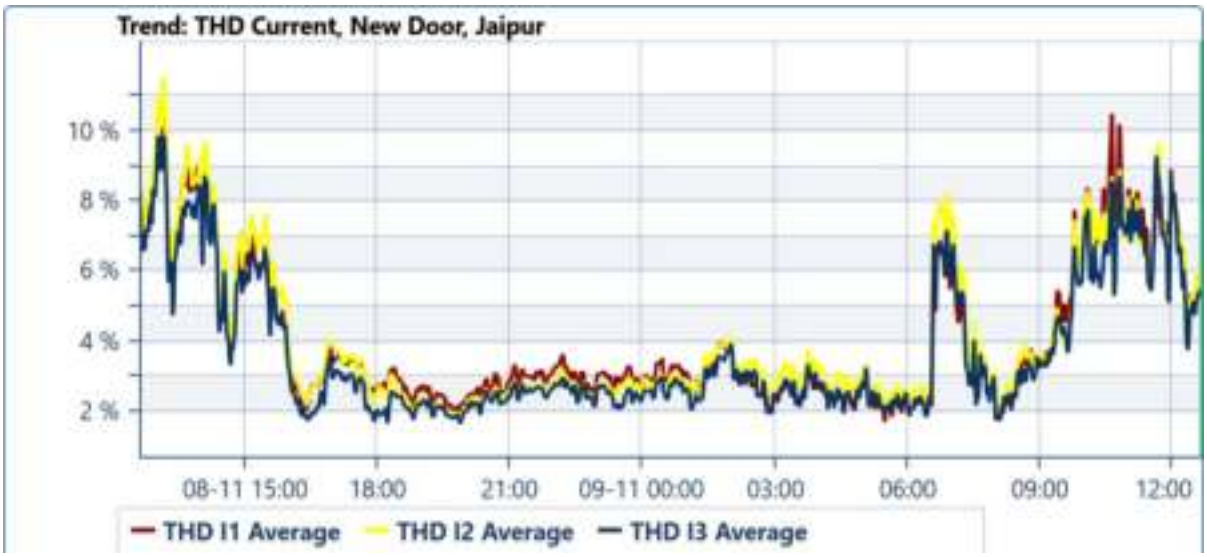
Parameter	Min	Max	Average
Power Factor 1 (Auto)	0.937 CAP	0.858 IND	0.999 IND
Power Factor 2 (Auto)	0.926 CAP	0.839 IND	0.999 CAP
Power Factor 3 (Auto)	0.934 CAP	0.85 IND	0.999 IND
Power Factor Total (Auto)	0.932 CAP	0.849 IND	0.999 IND

Trend of THD Voltage, New Door, Jaipur



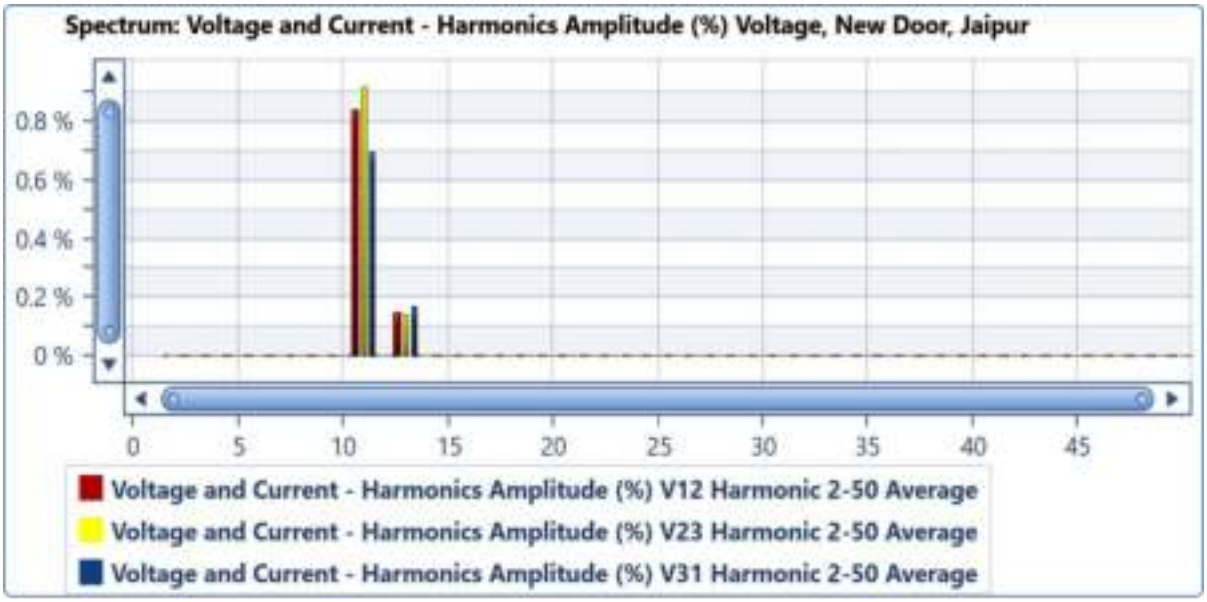
Parameter	Min	Max	Average
THD V12 (Auto)	0 %	4.93 %	0.87 %
THD V23 (Auto)	0 %	4.05 %	0.94 %
THD V31 (Auto)	0 %	4.05 %	0.74 %

Trend of THD Current, New Door, Jaipur

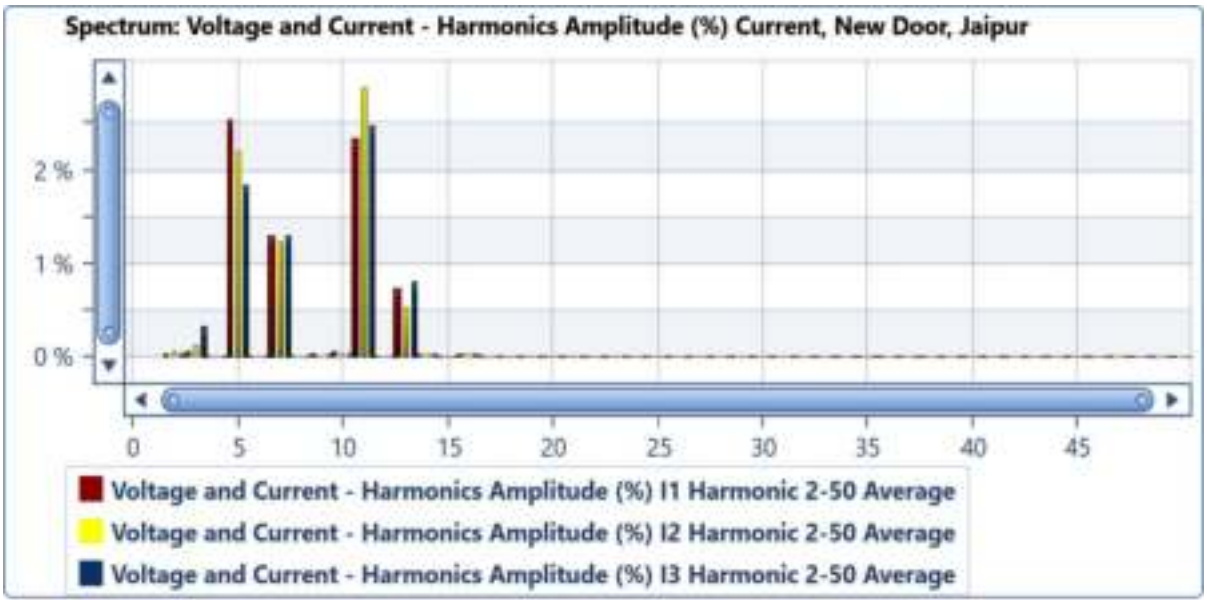


Parameter	Min	Max	Average
THD I1 (Auto)	1.06 %	33.55 %	4.03 %
THD I2 (Auto)	1.05 %	45.63 %	4.12 %
THD I3 (Auto)	0.94 %	50.77 %	3.73 %

Harmonics Amplitude (%) Voltage, New Door, Jaipur

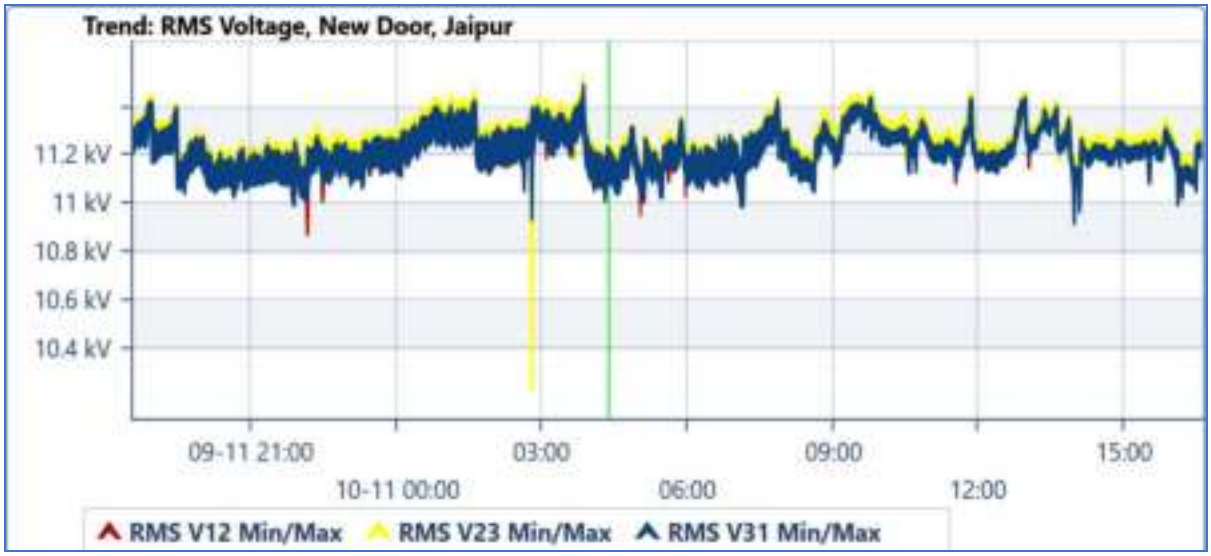


Harmonics Amplitude (%) Current, New Door, Jaipur



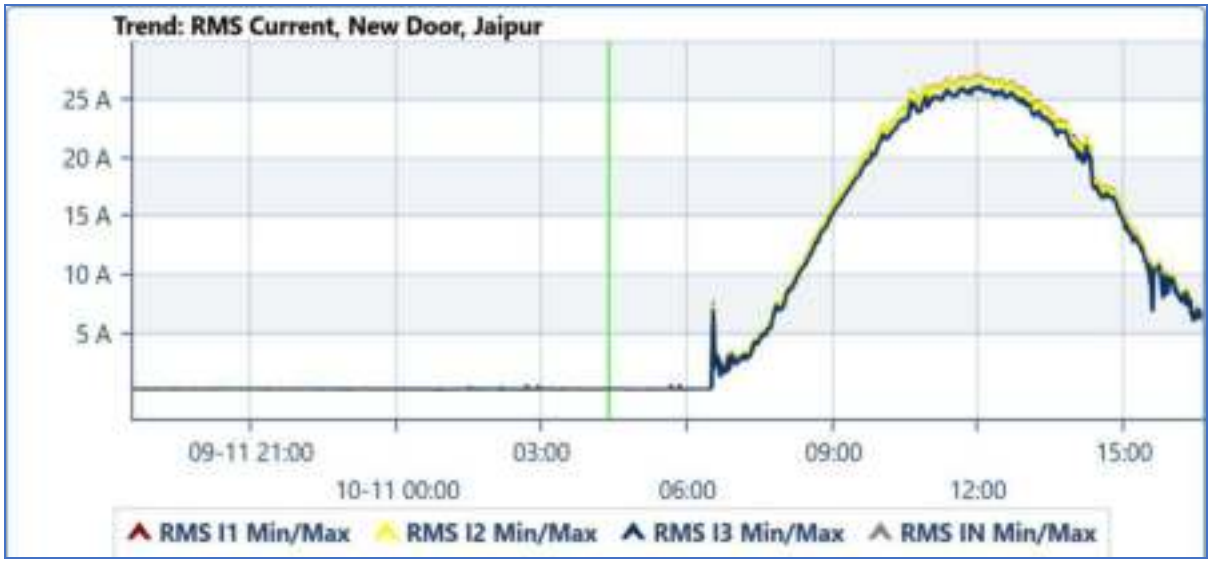
2. Solar HT Side

Trend of RMS Voltage, New Door, Jaipur



Parameter	Min	Max	Average
RMS V12 (Auto)	10.866 kV	11.506 kV	11.237 kV
RMS V23 (Auto)	10.23 kV	11.538 kV	11.269 kV
RMS V31 (Auto)	10.914 kV	11.498 kV	11.223 kV

Trend of RMS Current, New Door, Jaipur

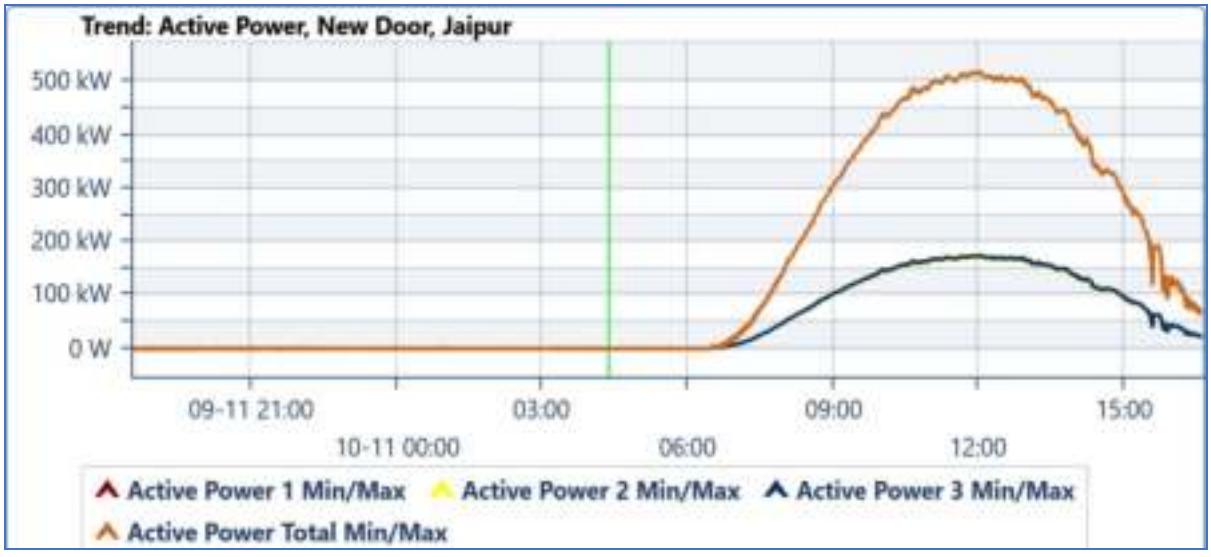


Parameter	Min	Max	Average
RMS I1 (Auto)	0.218 A	27.242 A	7.969 A
RMS I2 (Auto)	0.21 A	27.149 A	7.967 A
RMS I3 (Auto)	0.207 A	26.328 A	7.726 A

Trend of Apparent Power, New Door, Jaipur

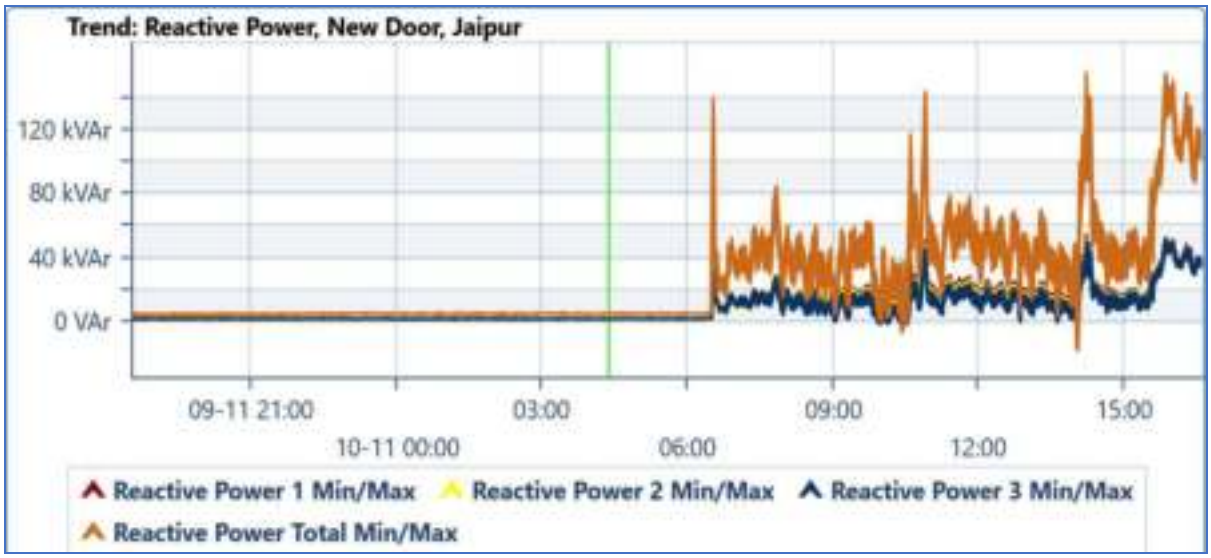
Parameter	Min	Max	Average
Apparent Power 1 (Auto)	404.128 VA	176.639 kVA	51.383 kVA
Apparent Power 2 (Auto)	183.809 VA	173.348 kVA	50.511 kVA
Apparent Power 3 (Auto)	658.045 VA	175.588 kVA	51.166 kVA
Apparent Power Total (Auto)	3.664 kVA	522.36 kVA	153.06 kVA

Trend of Active Power, New Door, Jaipur



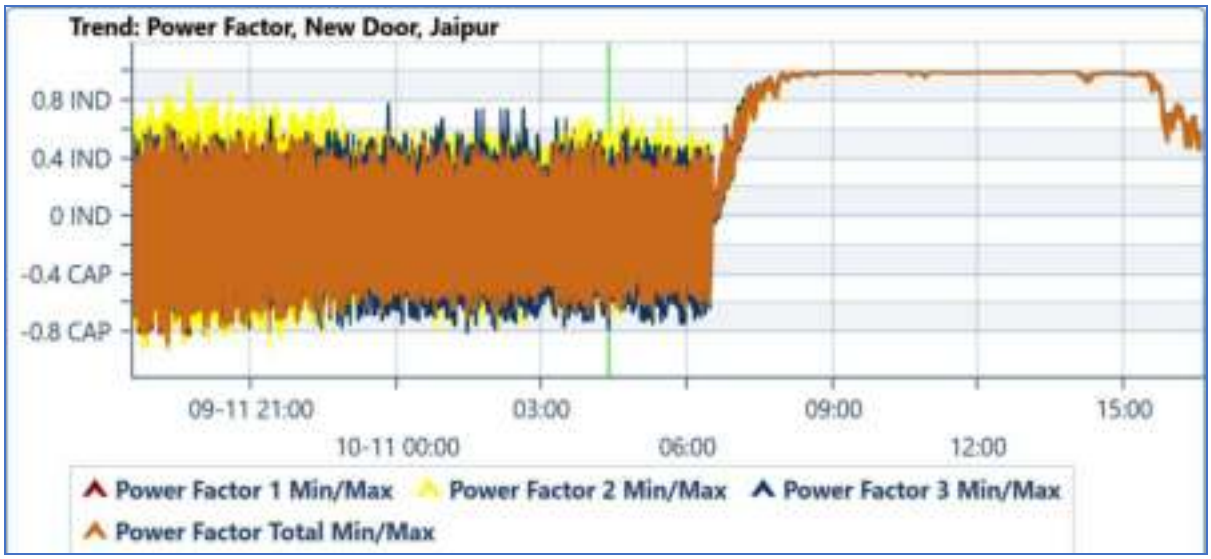
Parameter	Min	Max	Average
Active Power 1 (Auto)	-1.876 kW	175.623 kW	48.838 kW
Active Power 2 (Auto)	-1.564 kW	172.886 kW	48.076 kW
Active Power 3 (Auto)	-1.324 kW	175.054 kW	48.753 kW
Active Power Total (Auto)	-3.899 kW	520.123 kW	145.667 kW

Trend of Reactive Power, New Door, Jaipur



Parameter	Min	Max	Average
Reactive Power 1 (Auto)	-4.687 kVAr	54.795 kVAr	9.096 kVAr
Reactive Power 2 (Auto)	-6.473 kVAr	51.955 kVAr	8.476 kVAr
Reactive Power 3 (Auto)	-8.497 kVAr	51.93 kVAr	7.919 kVAr
Reactive Power Total (Auto)	-18.717 kVAr	157.276 kVAr	25.49 kVAr

Trend of Power Factor, New Door, Jaipur

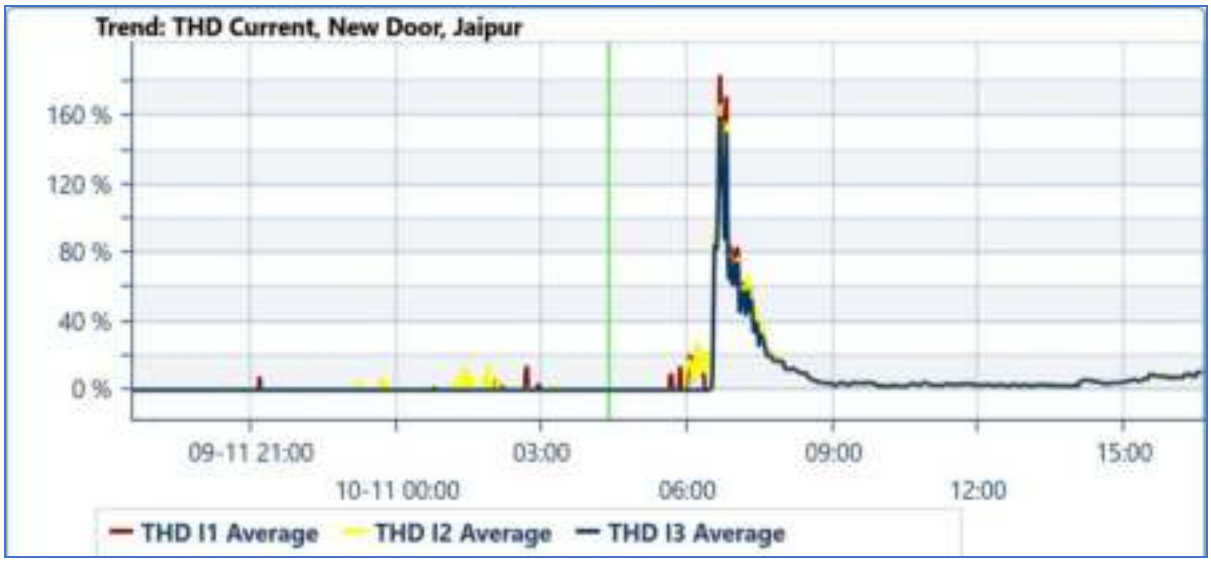


Parameter	Min	Max	Average
Power Factor 1 (Auto)	0.999 CAP	-0.911 CAP	0.95 IND
Power Factor 2 (Auto)	0.999 CAP	-0.924 CAP	0.952 IND
Power Factor 3 (Auto)	0.998 CAP	-0.852 CAP	0.953 IND
Power Factor Total (Auto)	0.999 CAP	-0.89 CAP	0.952 IND

Trend of THD Voltage, New Door, Jaipur

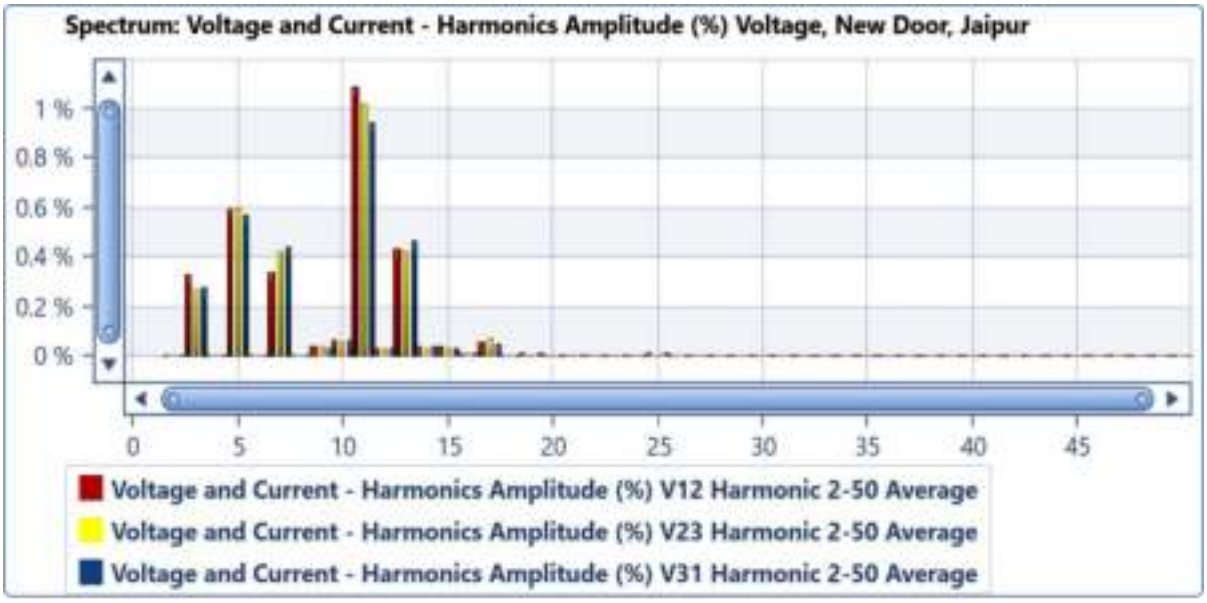
Parameter	Min	Max	Average
THD V12 (Auto)	0.39 %	3.78 %	1.5 %
THD V23 (Auto)	0.51 %	5.15 %	1.45 %
THD V31 (Auto)	0.4 %	3.6 %	1.41 %

Trend of THD Current, New Door, Jaipur

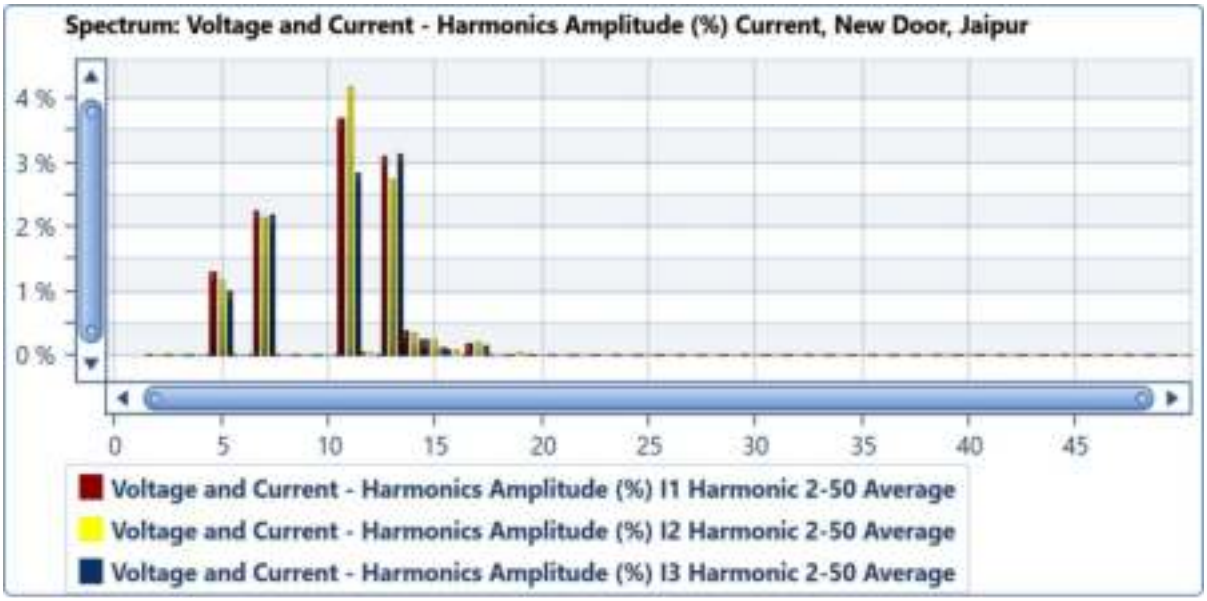


Parameter	Min	Max	Average
THD I1 (Auto)	0 %	263.45 %	6.23 %
THD I2 (Auto)	0 %	243.91 %	6.23 %
THD I3 (Auto)	0 %	233.39 %	5.38 %

Harmonics Amplitude (%) Voltage, New Door, Jaipur

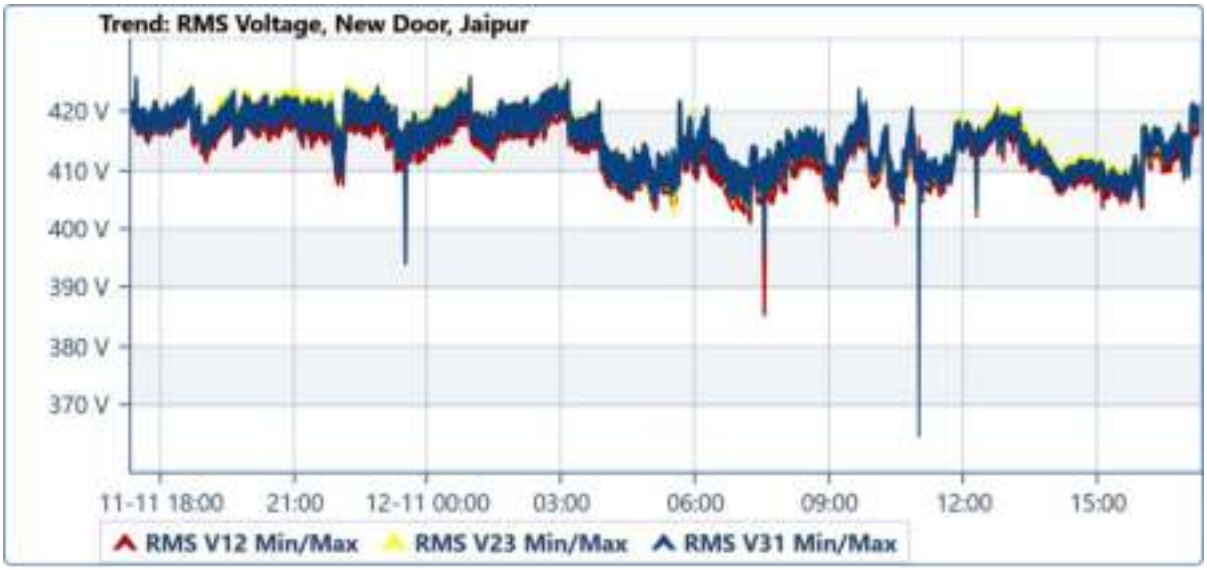


Harmonics Amplitude (%) Current, New Door, Jaipur



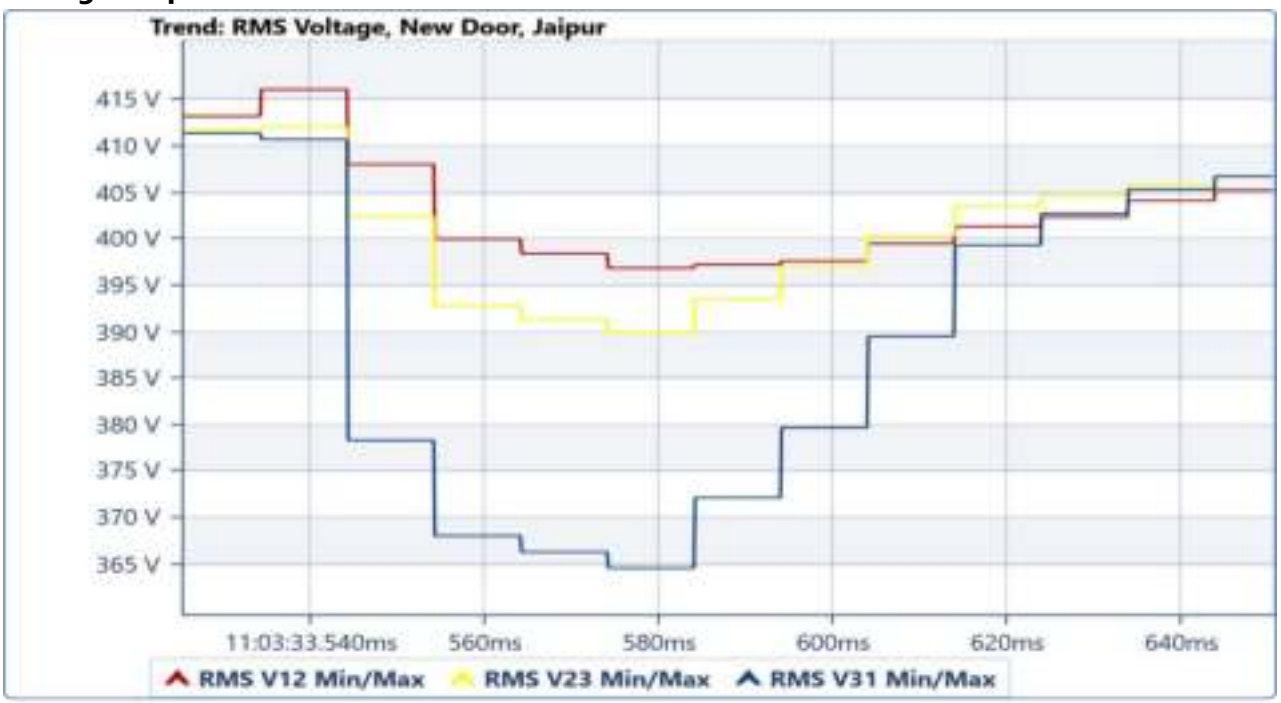
3.Transformer-1

Trend of RMS Voltage, New Door, Jaipur

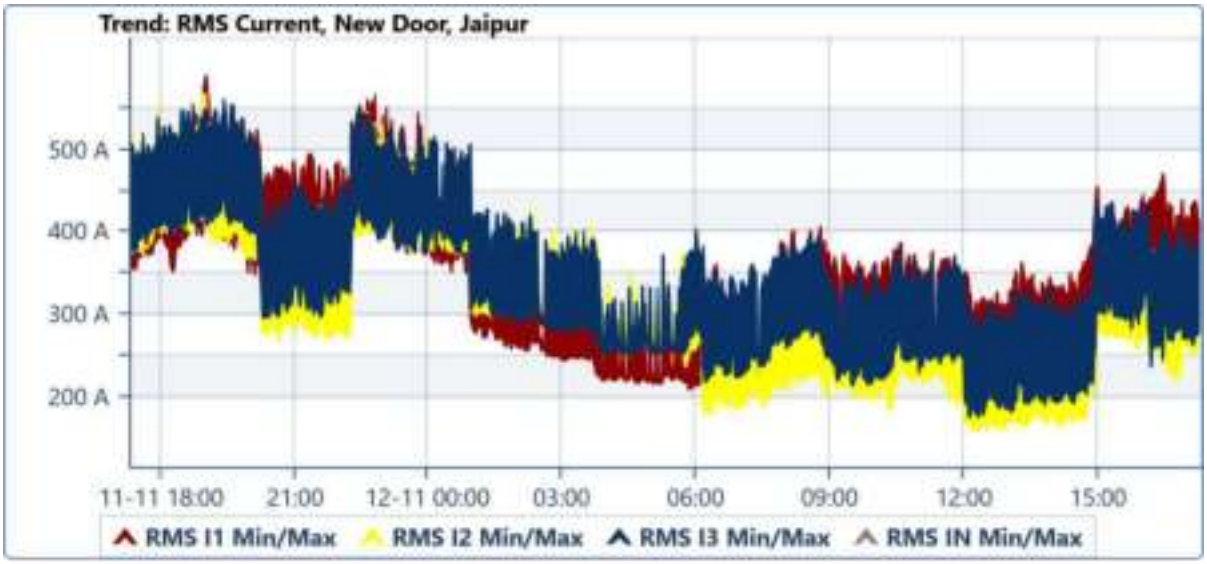


Parameter	Min	Max	Average
RMS V12 (Auto)	385.346 V	425.526 V	414.061 V
RMS V23 (Auto)	389.995 V	426.251 V	415.637 V
RMS V31 (Auto)	364.643 V	426.215 V	415.304 V

Voltage drops

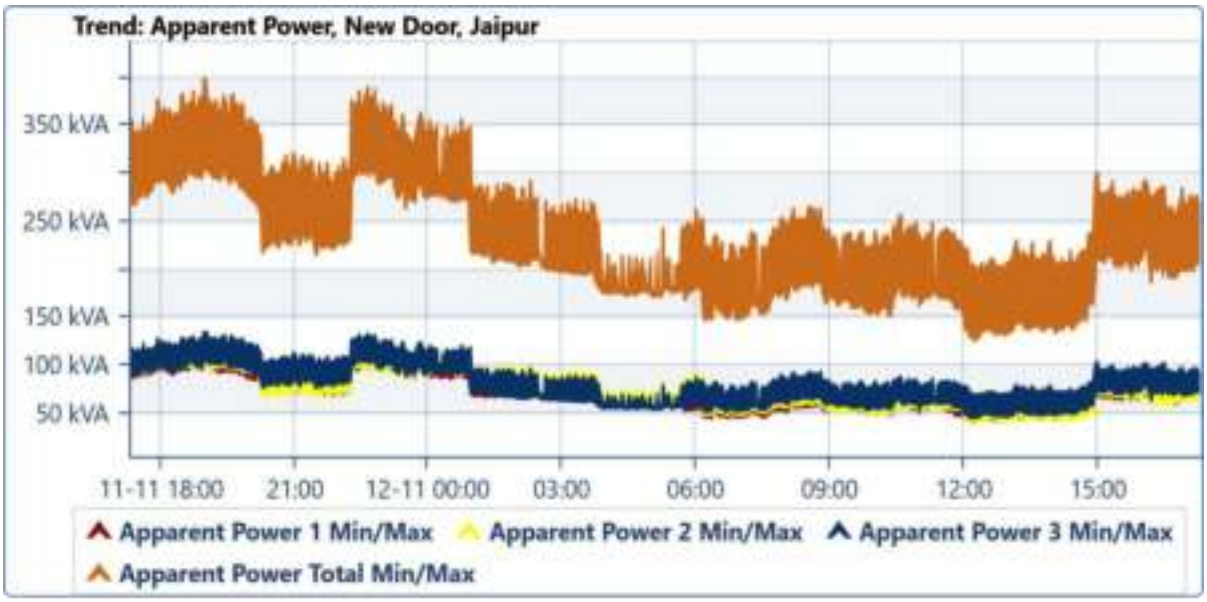


Trend of RMS Current, New Door, Jaipur



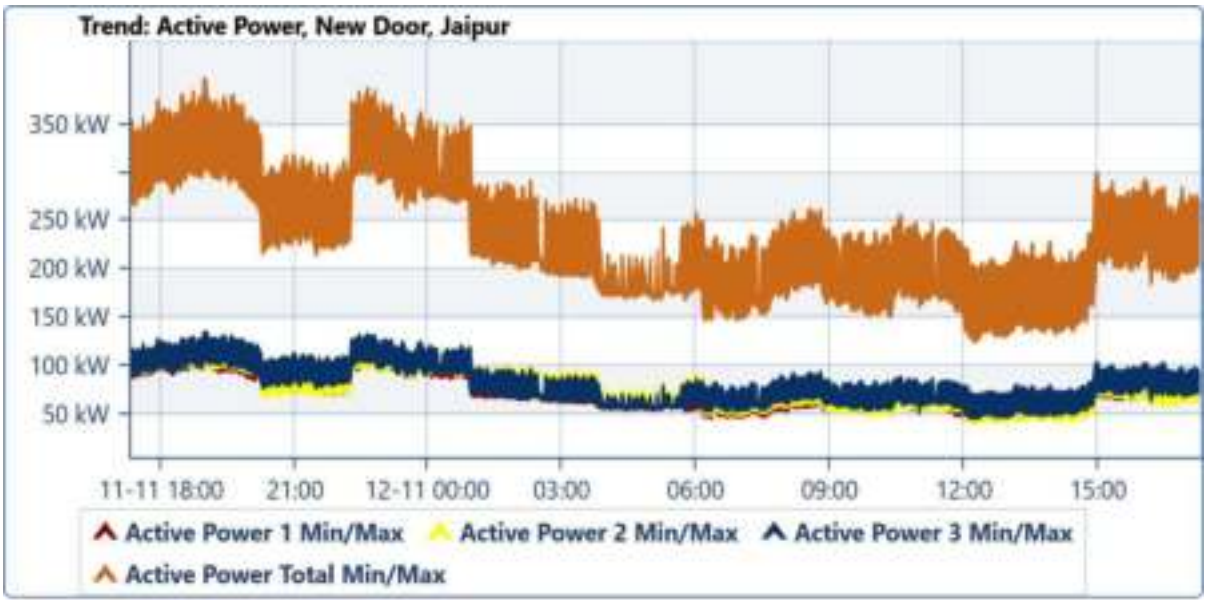
Parameter	Min	Max	Average
RMS I1 (Auto)	188.461 A	590.27 A	301.949 A
RMS I2 (Auto)	156.118 A	568.343 A	284.825 A
RMS I3 (Auto)	174.881 A	562.127 A	304.84 A

Trend of Apparent Power, New Door, Jaipur



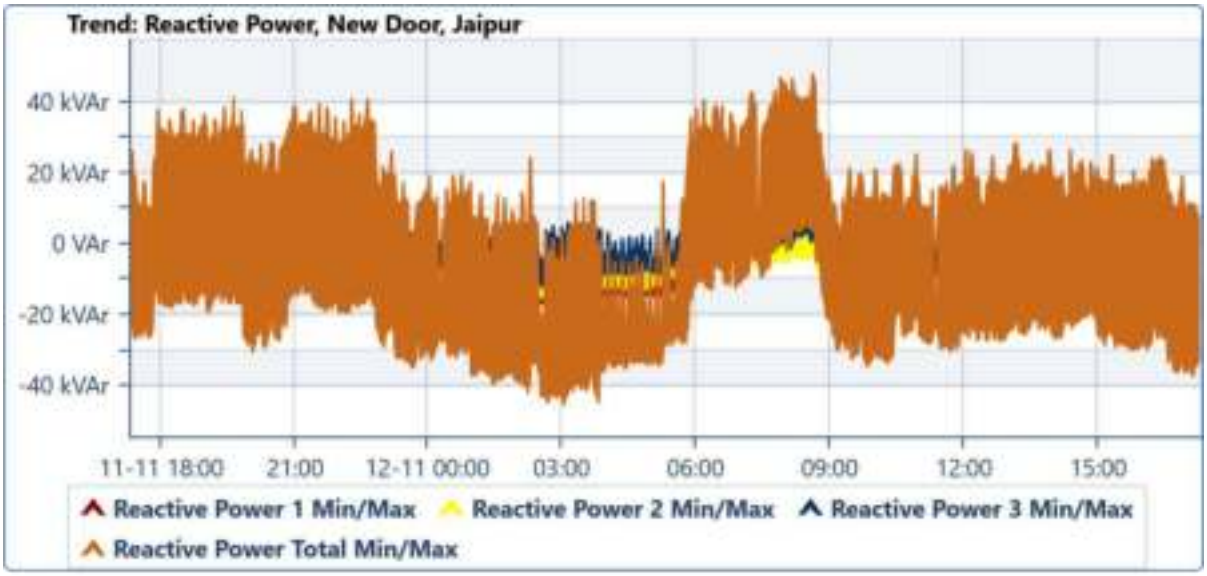
Parameter	Min	Max	Average
Apparent Power 1 (Auto)	39.785 kVA	134.729 kVA	68.986 kVA
Apparent Power 2 (Auto)	39.744 kVA	130.134 kVA	70.624 kVA
Apparent Power 3 (Auto)	43.961 kVA	136.28 kVA	73.57 kVA
Apparent Power Total (Auto)	123.49 kVA	400.312 kVA	213.181 kVA

Trend of Active Power, New Door, Jaipur



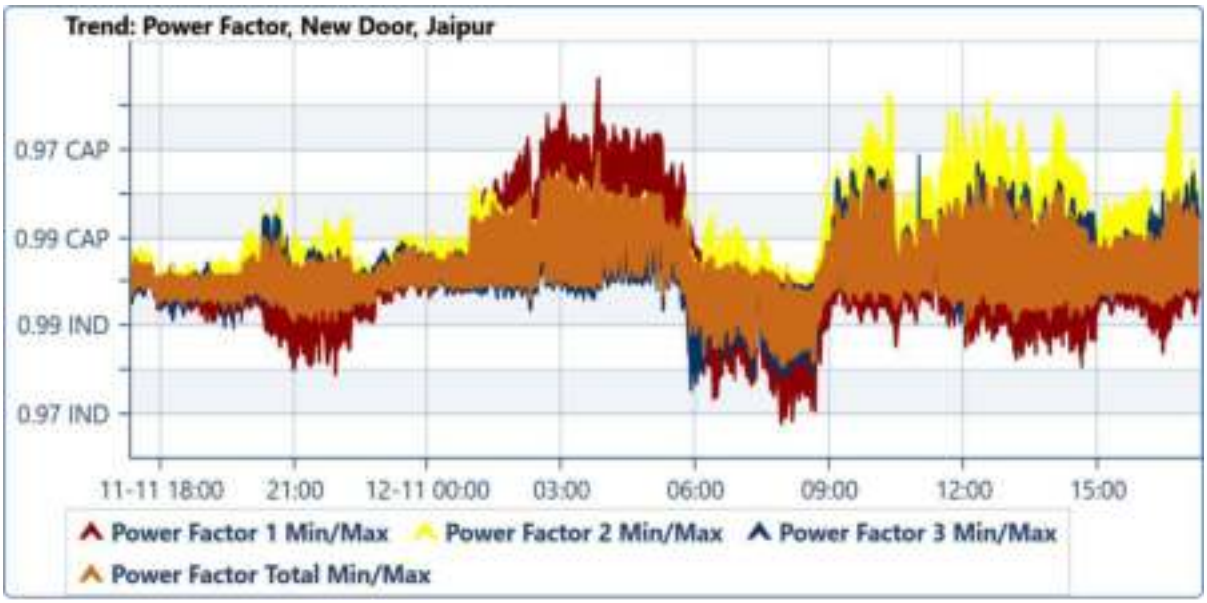
Parameter	Min	Max	Average
Active Power 1 (Auto)	39.578 kW	134.025 kW	68.66 kW
Active Power 2 (Auto)	38.851 kW	129.953 kW	70.063 kW
Active Power 3 (Auto)	43.632 kW	135.977 kW	73.261 kW
Active Power Total (Auto)	122.475 kW	399.07 kW	211.984 kW

Trend of Reactive Power, New Door, Jaipur



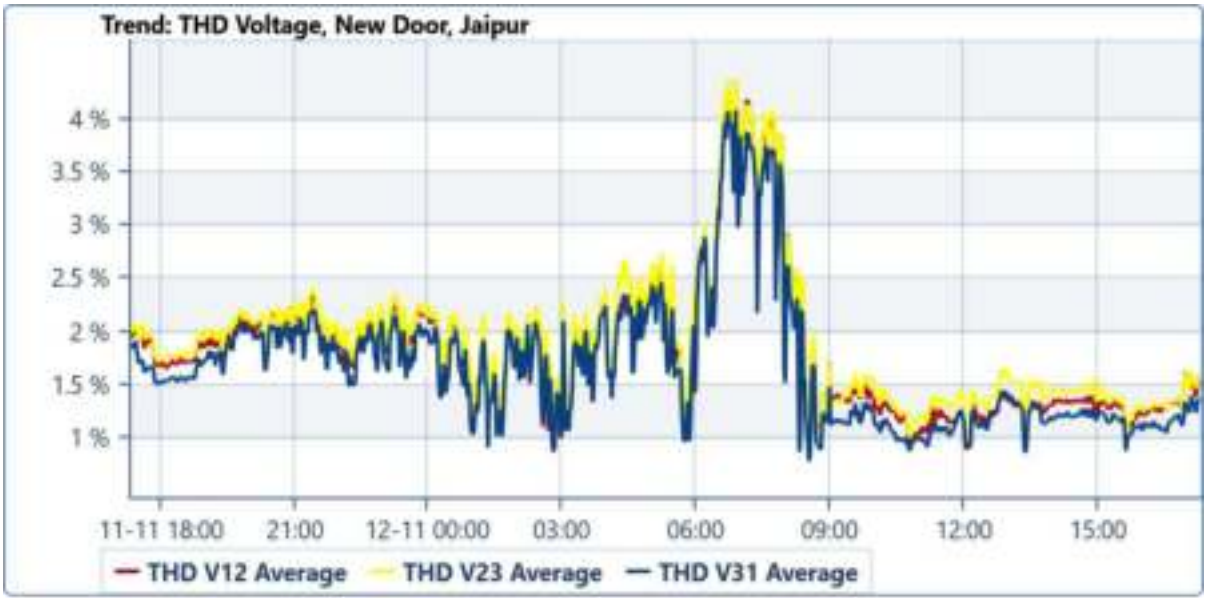
Parameter	Min	Max	Average
Reactive Power 1 (Auto)	-18.376 kVAr	20.56 kVAr	-3.612 kVAr
Reactive Power 2 (Auto)	-18.008 kVAr	11.886 kVAr	-7.978 kVAr
Reactive Power 3 (Auto)	-16.408 kVAr	18.612 kVAr	-5.049 kVAr
Reactive Power Total (Auto)	-45.345 kVAr	48.061 kVAr	-16.638 kVAr

Trend of Power Factor, New Door, Jaipur



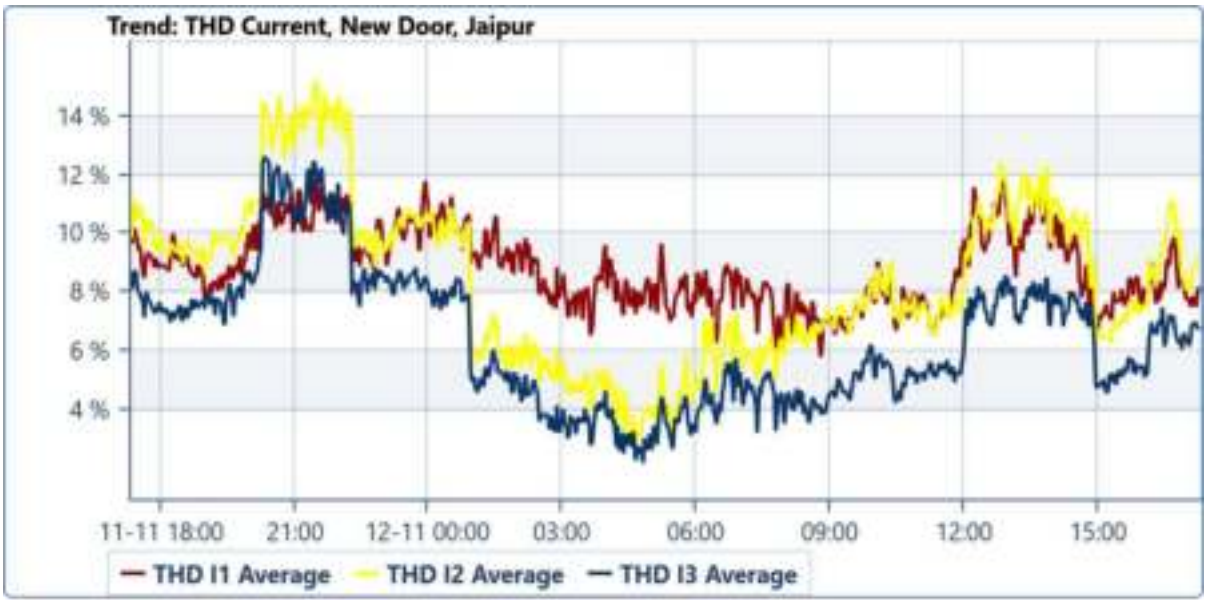
Parameter	Min	Max	Average
Power Factor 1 (Auto)	0.953 CAP	0.968 IND	0.995 CAP
Power Factor 2 (Auto)	0.956 CAP	0.99 IND	0.992 CAP
Power Factor 3 (Auto)	0.971 CAP	0.975 IND	0.996 CAP
Power Factor Total (Auto)	0.97 CAP	0.98 IND	0.994 CAP

Trend of THD Voltage, New Door, Jaipur



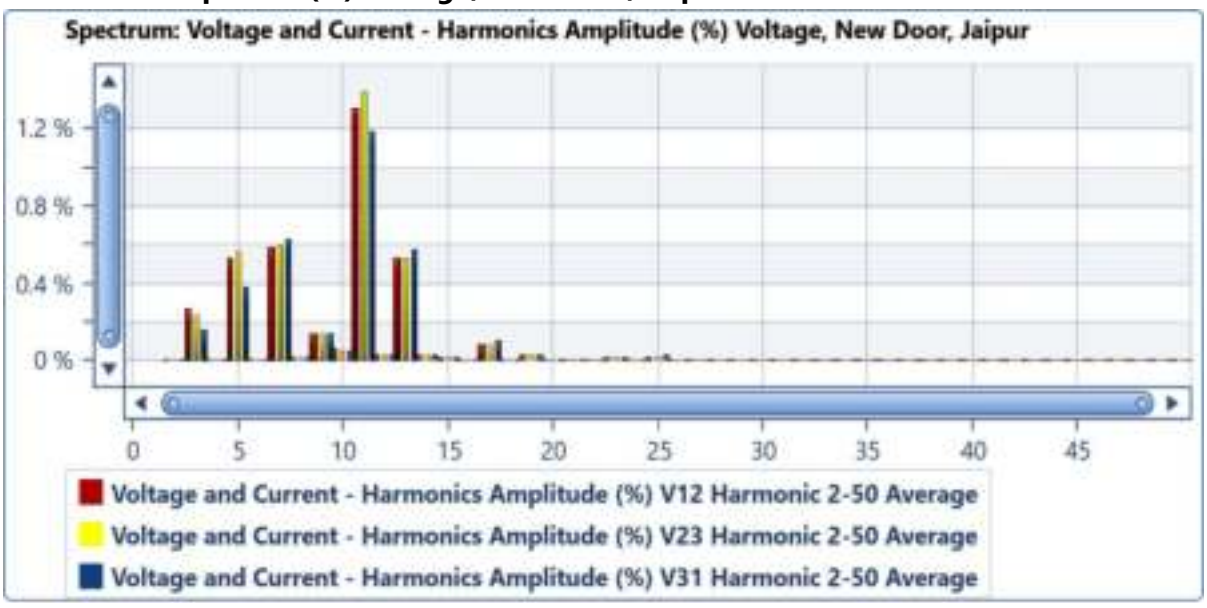
Parameter	Min	Max	Average
THD V12 (Auto)	0.37 %	6.13 %	1.79 %
THD V23 (Auto)	0.43 %	6.19 %	1.88 %
THD V31 (Auto)	0.35 %	5.74 %	1.67 %

Trend of THD Current, New Door, Jaipur

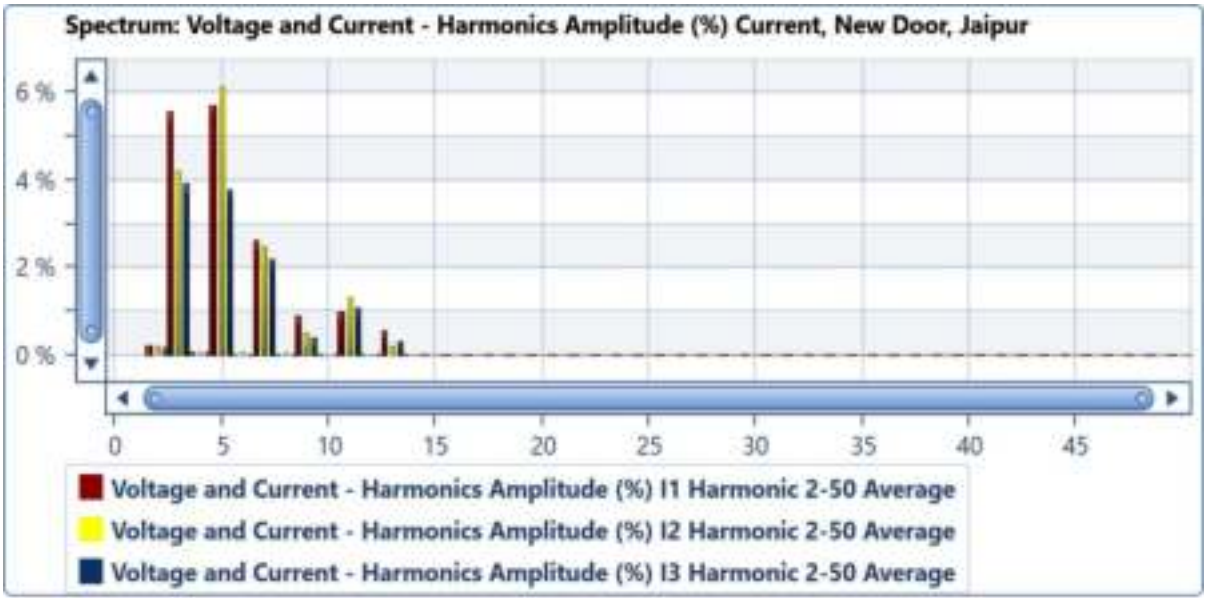


Parameter	Min	Max	Average
THD I1 (Auto)	3.54 %	22.75 %	8.82 %
THD I2 (Auto)	2.13 %	25.53 %	8.39 %
THD I3 (Auto)	1.71 %	20.95 %	6.37 %

Harmonics Amplitude (%) Voltage, New Door, Jaipur

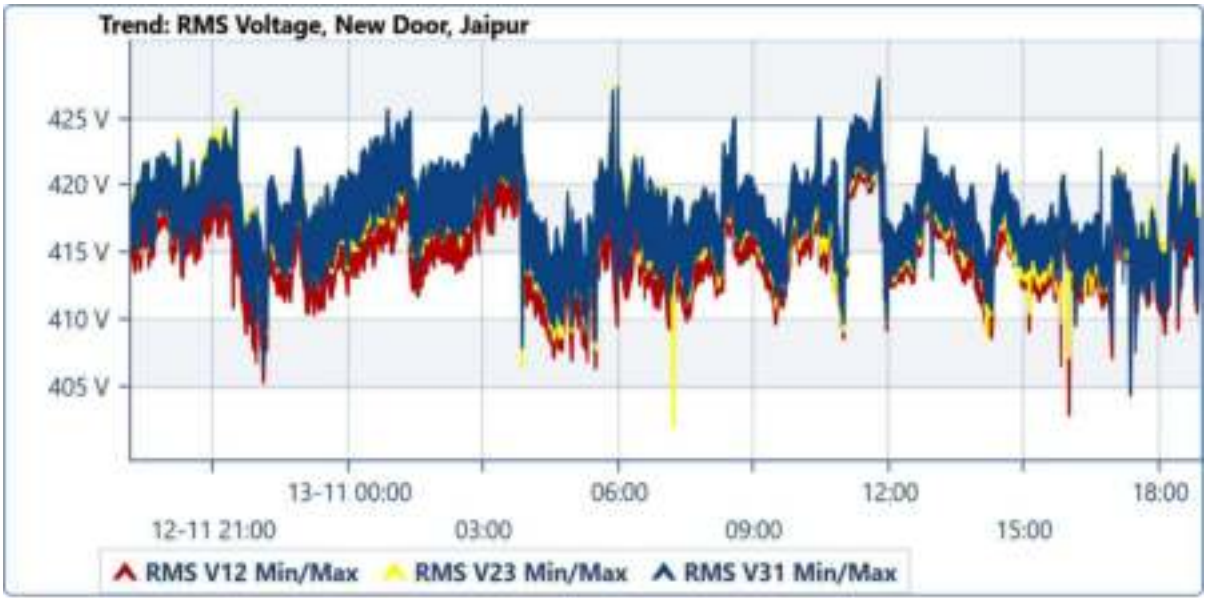


Harmonics Amplitude (%) Current, New Door, Jaipur



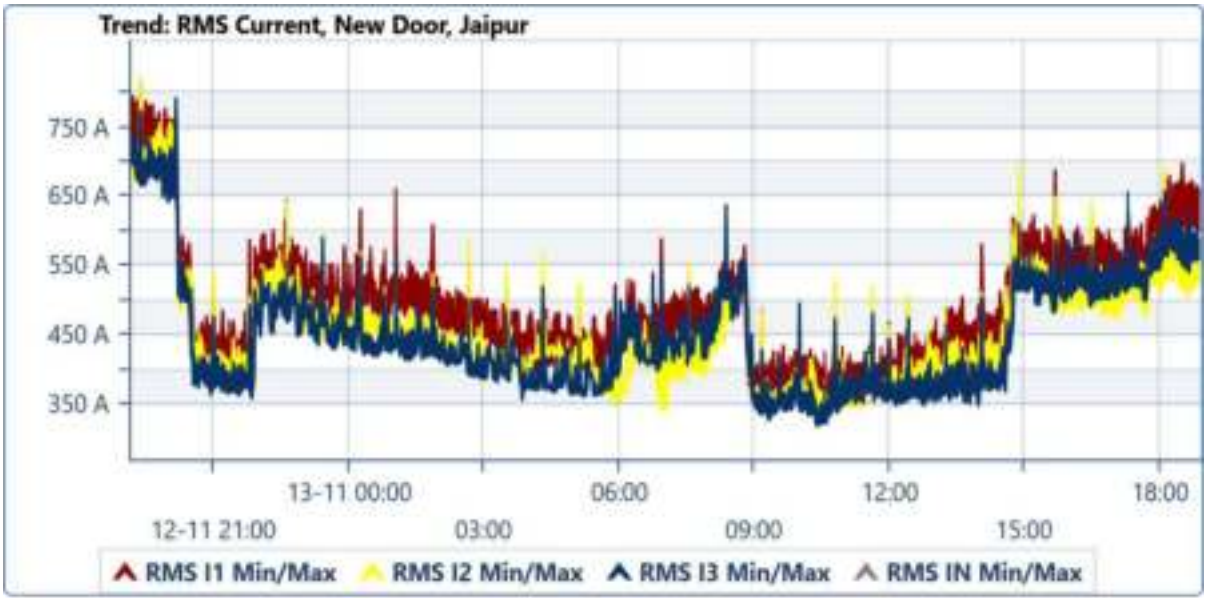
4.Transformer -2

Trend of RMS Voltage, New Door, Jaipur



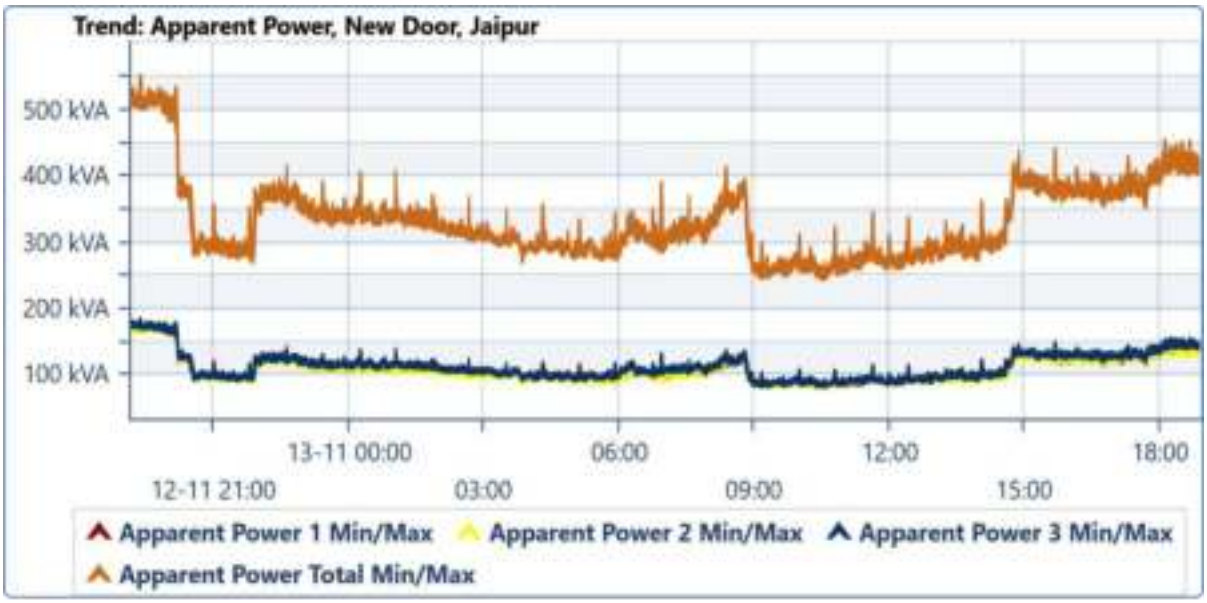
Parameter	Min	Max	Average
RMS V12 (Auto)	402.816 V	427.318 V	415.989 V
RMS V23 (Auto)	402.026 V	428.078 V	417.508 V
RMS V31 (Auto)	404.283 V	428.166 V	417.719 V

Trend of RMS Current, New Door, Jaipur



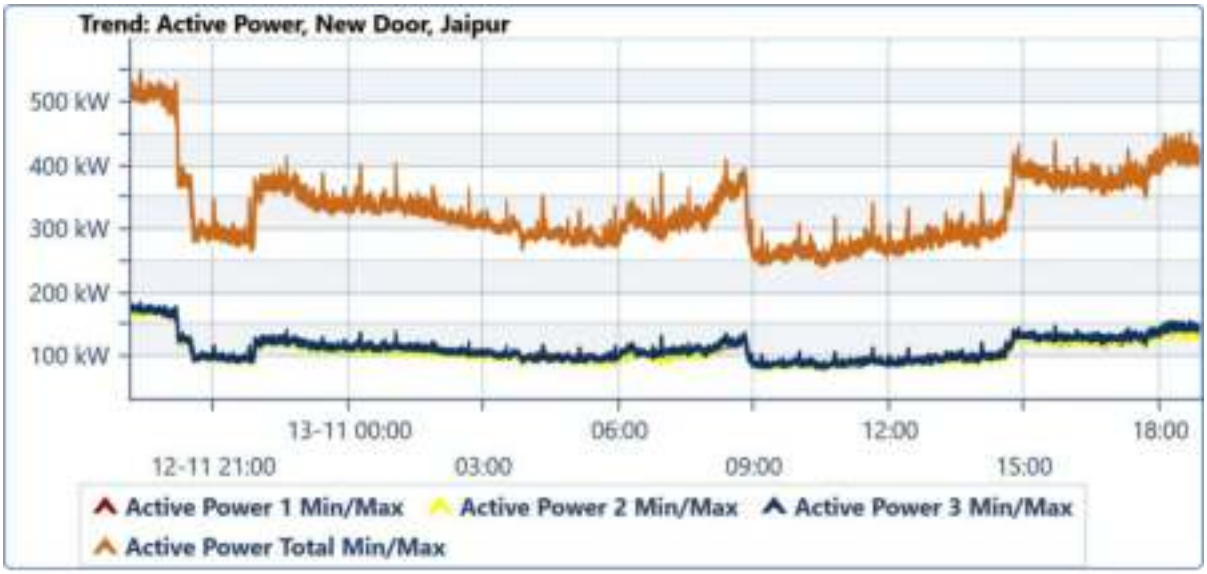
Parameter	Min	Max	Average
RMS I1 (Auto)	346.521 A	821.51 A	478.857 A
RMS I2 (Auto)	338.023 A	822.86 A	450.879 A
RMS I3 (Auto)	318.946 A	793.016 A	443.488 A

Trend of Apparent Power, New Door, Jaipur



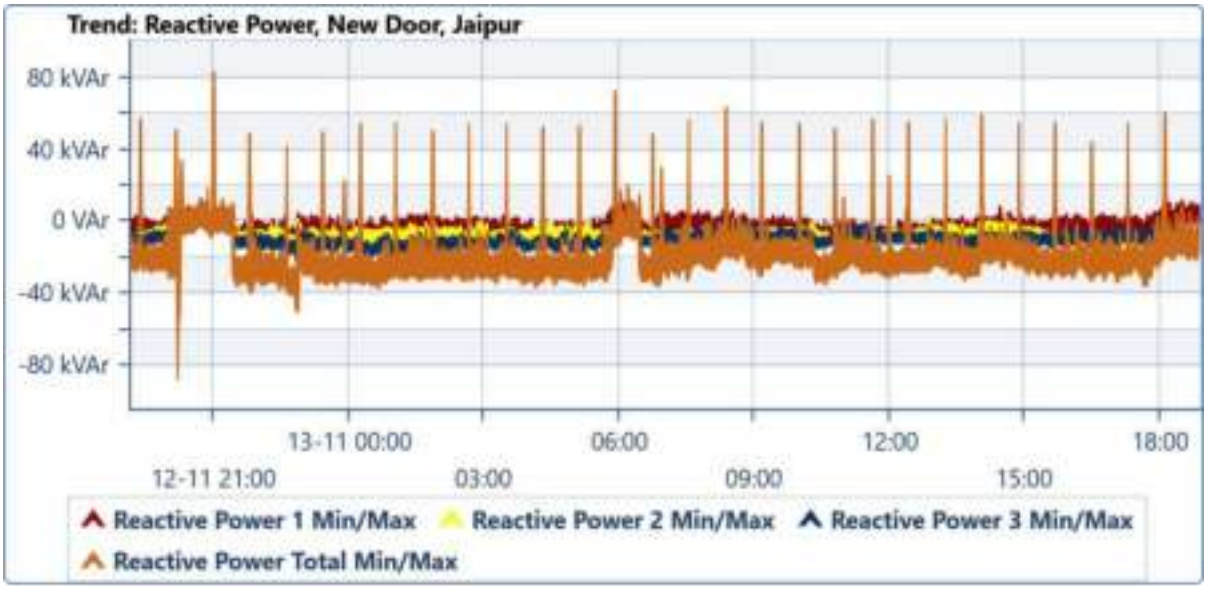
Parameter	Min	Max	Average
Apparent Power 1 (Auto)	80.665 kVA	185.737 kVA	110.666 kVA
Apparent Power 2 (Auto)	78.618 kVA	182.983 kVA	107.597 kVA
Apparent Power 3 (Auto)	81.288 kVA	187.394 kVA	112.023 kVA
Apparent Power Total (Auto)	243.523 kVA	553.942 kVA	330.286 kVA

Trend of Active Power, New Door, Jaipur



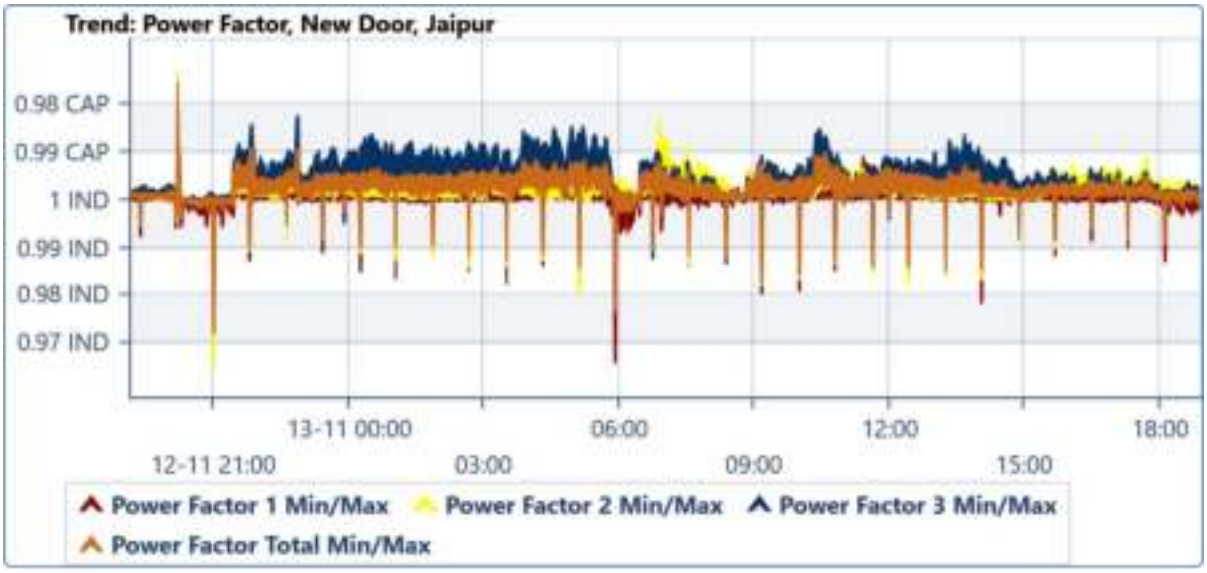
Parameter	Min	Max	Average
Active Power 1 (Auto)	80.366 kW	184.527 kW	110.525 kW
Active Power 2 (Auto)	78.103 kW	182.764 kW	107.34 kW
Active Power 3 (Auto)	80.512 kW	186.892 kW	111.582 kW
Active Power Total (Auto)	241.652 kW	551.505 kW	329.447 kW

Trend of Reactive Power, New Door, Jaipur



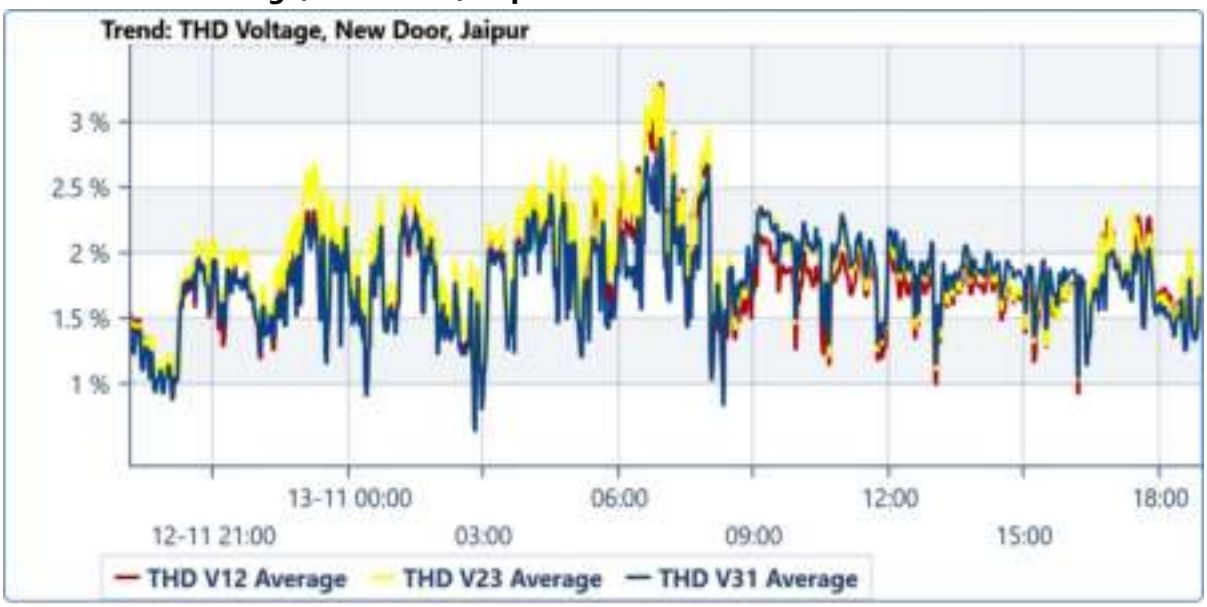
Parameter	Min	Max	Average
Reactive Power 1 (Auto)	-28.443 kVAr	29.745 kVAr	-4.348 kVAr
Reactive Power 2 (Auto)	-30.906 kVAr	31.102 kVAr	-6.896 kVAr
Reactive Power 3 (Auto)	-28.93 kVAr	23.922 kVAr	-9.115 kVAr
Reactive Power Total (Auto)	-88.279 kVAr	83.615 kVAr	-20.36 kVAr

Trend of Power Factor, New Door, Jaipur



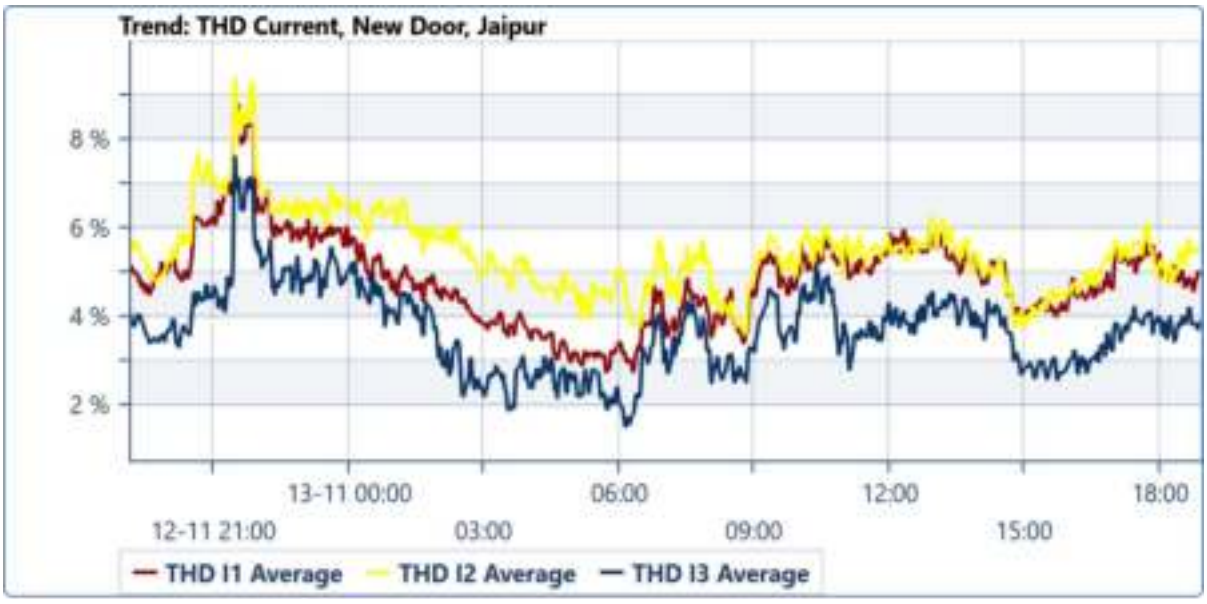
Parameter	Min	Max	Average
Power Factor 1 (Auto)	0.976 CAP	0.966 IND	0.999 CAP
Power Factor 2 (Auto)	0.973 CAP	0.965 IND	0.998 CAP
Power Factor 3 (Auto)	0.976 CAP	0.979 IND	0.996 CAP
Power Factor Total (Auto)	0.975 CAP	0.972 IND	0.997 CAP

Trend of THD Voltage, New Door, Jaipur



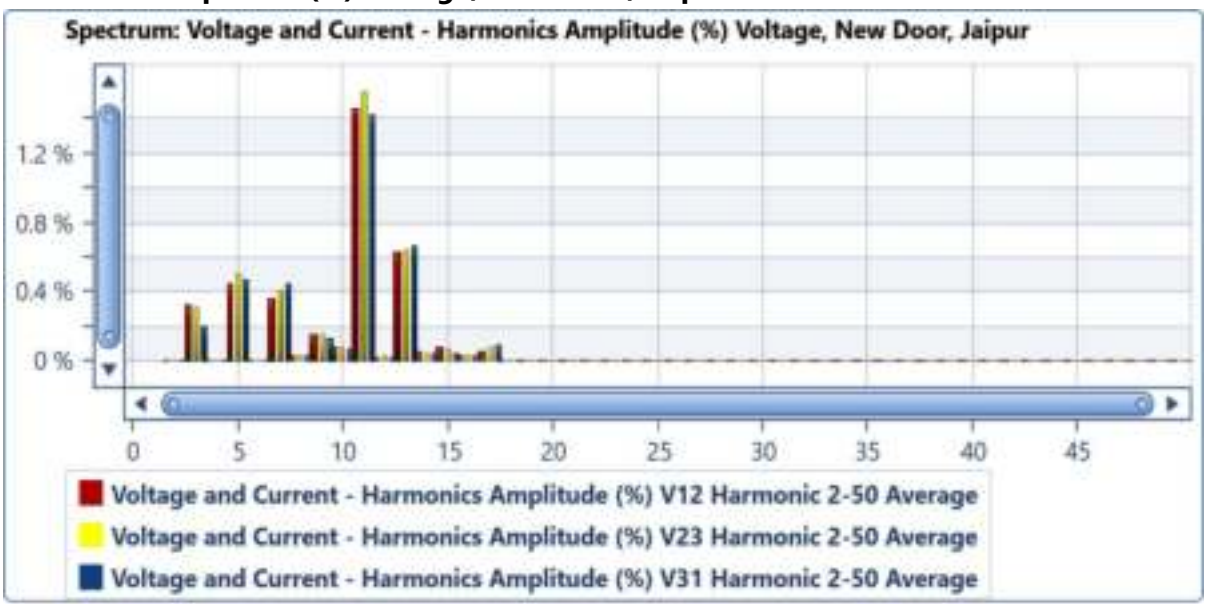
Parameter	Min	Max	Average
THD V12 (Auto)	0.45 %	4 %	1.79 %
THD V23 (Auto)	0.48 %	3.9 %	1.9 %
THD V31 (Auto)	0.39 %	3.74 %	1.79 %

Trend of THD Current, New Door, Jaipur

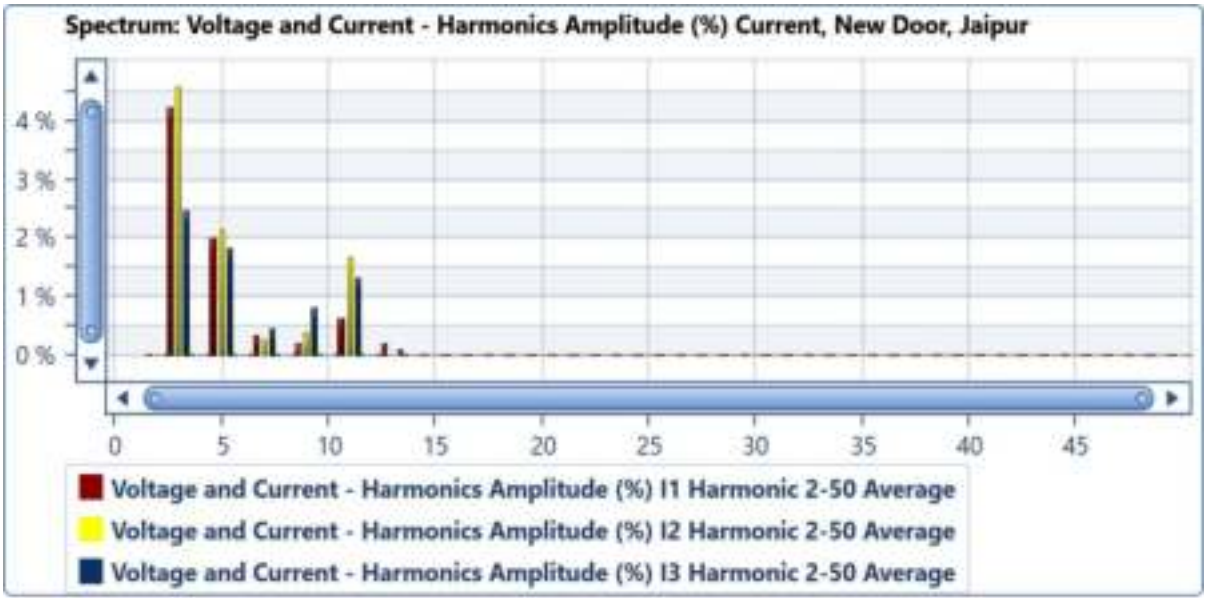


Parameter	Min	Max	Average
THD I1 (Auto)	1.88 %	15.14 %	4.86 %
THD I2 (Auto)	3.33 %	22.05 %	5.45 %
THD I3 (Auto)	1.22 %	17.51 %	3.71 %

Harmonics Amplitude (%) Voltage, New Door, Jaipur

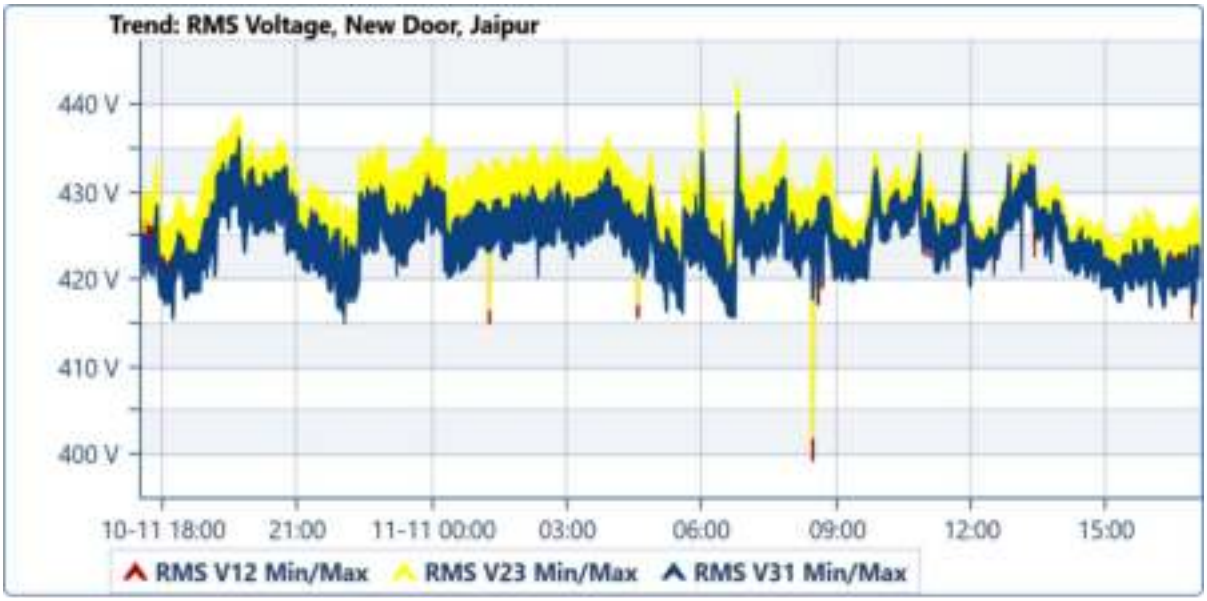


Harmonics Amplitude (%) Current, New Door, Jaipur



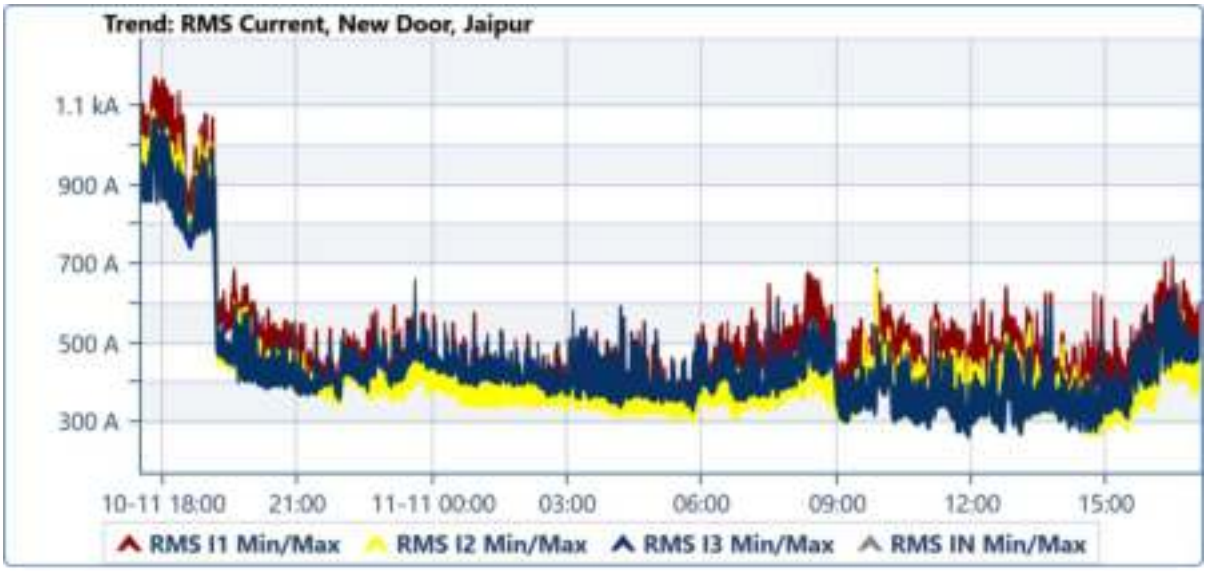
5.Transformer-3

Trend of RMS Voltage, New Door, Jaipur



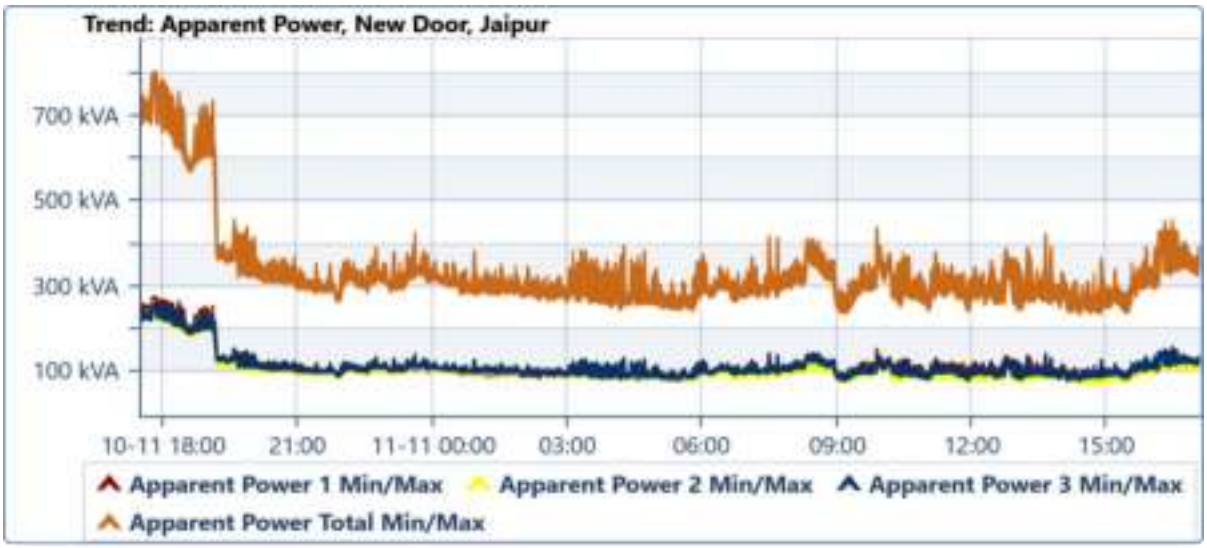
Parameter	Min	Max	Average
RMS V12 (Auto)	399.365 V	440.606 V	426.848 V
RMS V23 (Auto)	401.962 V	442.848 V	428.492 V
RMS V31 (Auto)	414.875 V	439.071 V	425.034 V

Trend of RMS Current, New Door, Jaipur



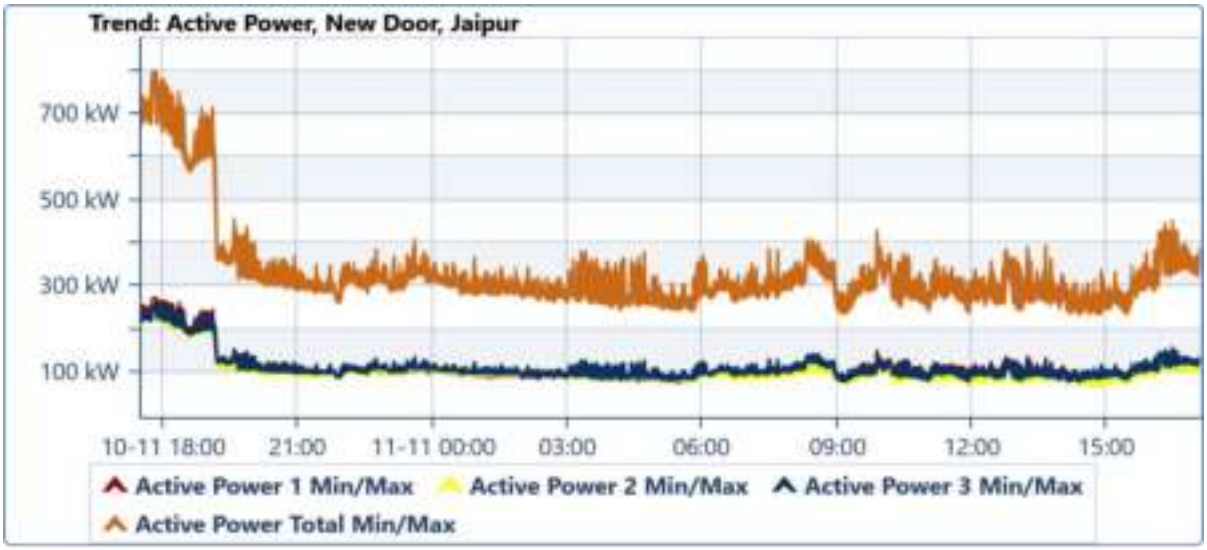
Parameter	Min	Max	Average
RMS I1 (Auto)	338.165 A	1.175 kA	487.346 A
RMS I2 (Auto)	263.54 A	1.091 kA	416.257 A
RMS I3 (Auto)	261.156 A	1.072 kA	431.589 A

Trend of Apparent Power, New Door, Jaipur



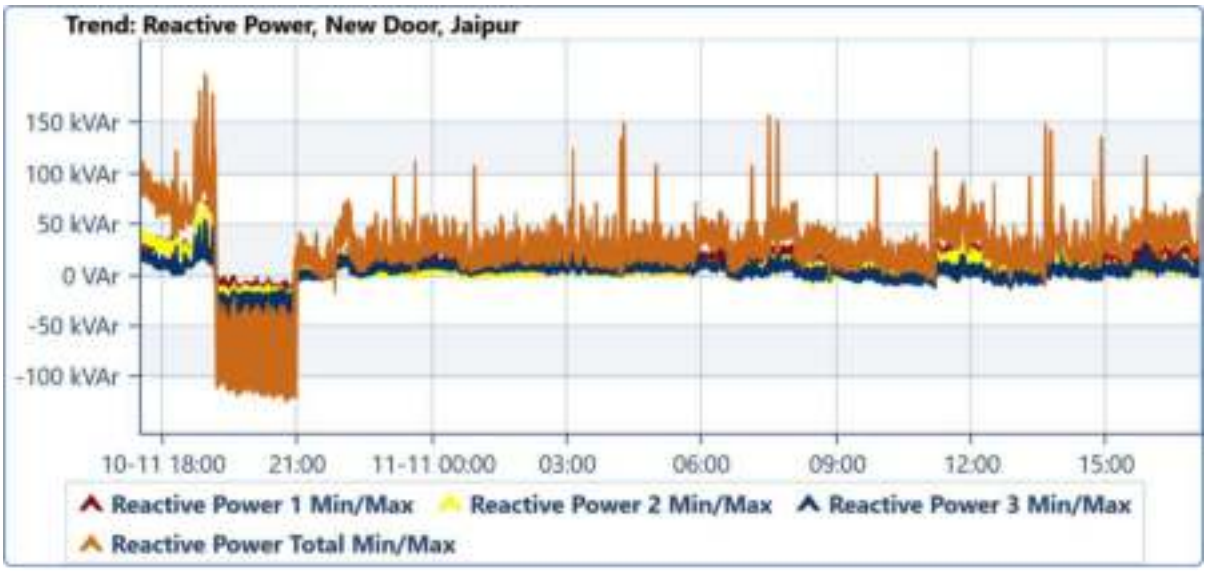
Parameter	Min	Max	Average
Apparent Power 1 (Auto)	77.216 kVA	277.929 kVA	111.262 kVA
Apparent Power 2 (Auto)	66.589 kVA	268.175 kVA	104.826 kVA
Apparent Power 3 (Auto)	77.139 kVA	265.29 kVA	111.872 kVA
Apparent Power Total (Auto)	233.658 kVA	806.447 kVA	327.96 kVA

Trend of Active Power, New Door, Jaipur



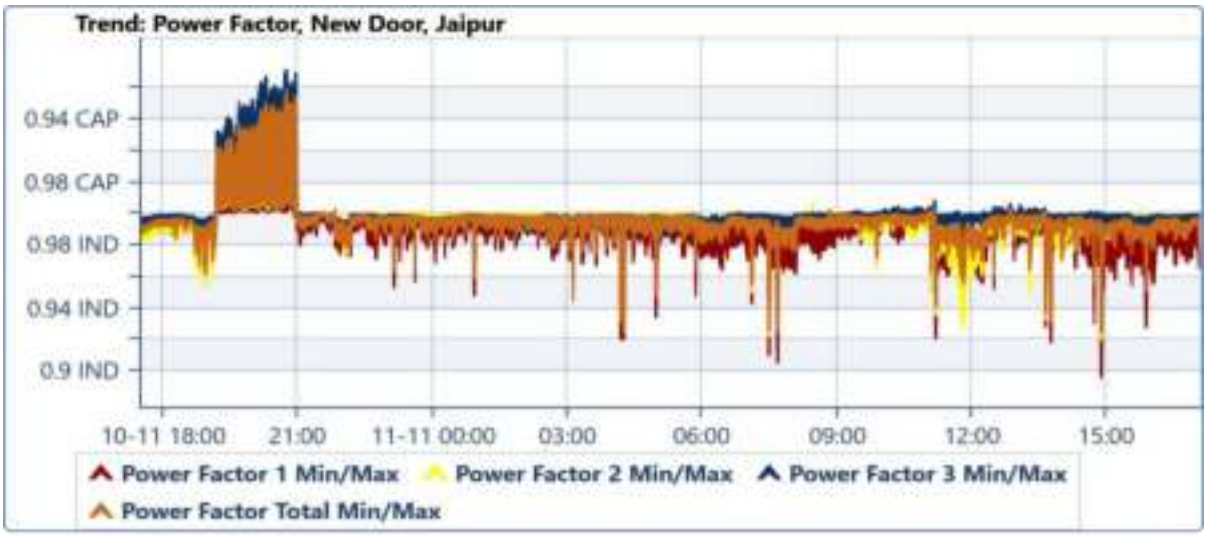
Parameter	Min	Max	Average
Active Power 1 (Auto)	76.883 kW	275.868 kW	110.123 kW
Active Power 2 (Auto)	66.367 kW	266.388 kW	104.233 kW
Active Power 3 (Auto)	77.134 kW	264.388 kW	111.404 kW
Active Power Total (Auto)	232.357 kW	801.417 kW	325.76 kW

Trend of Reactive Power, New Door, Jaipur



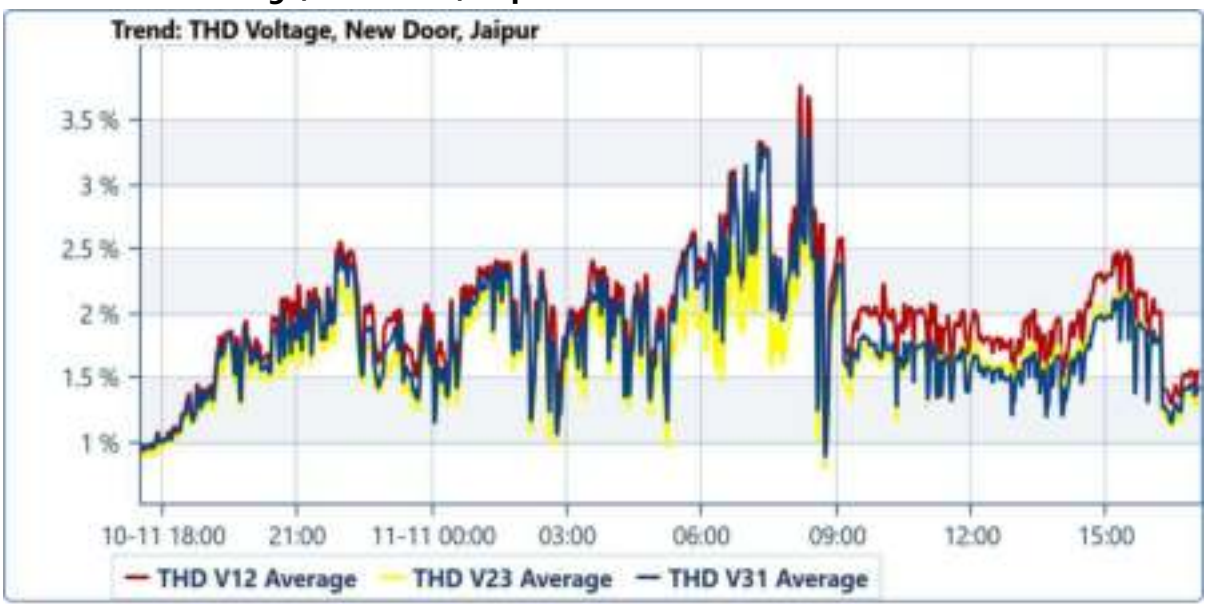
Parameter	Min	Max	Average
Reactive Power 1 (Auto)	-38.082 kVAr	73.427 kVAr	12.935 kVAr
Reactive Power 2 (Auto)	-41.998 kVAr	70.697 kVAr	6.56 kVAr
Reactive Power 3 (Auto)	-46.865 kVAr	55.146 kVAr	3.761 kVAr
Reactive Power Total (Auto)	-123.934 kVAr	199.27 kVAr	23.256 kVAr

Trend of Power Factor, New Door, Jaipur



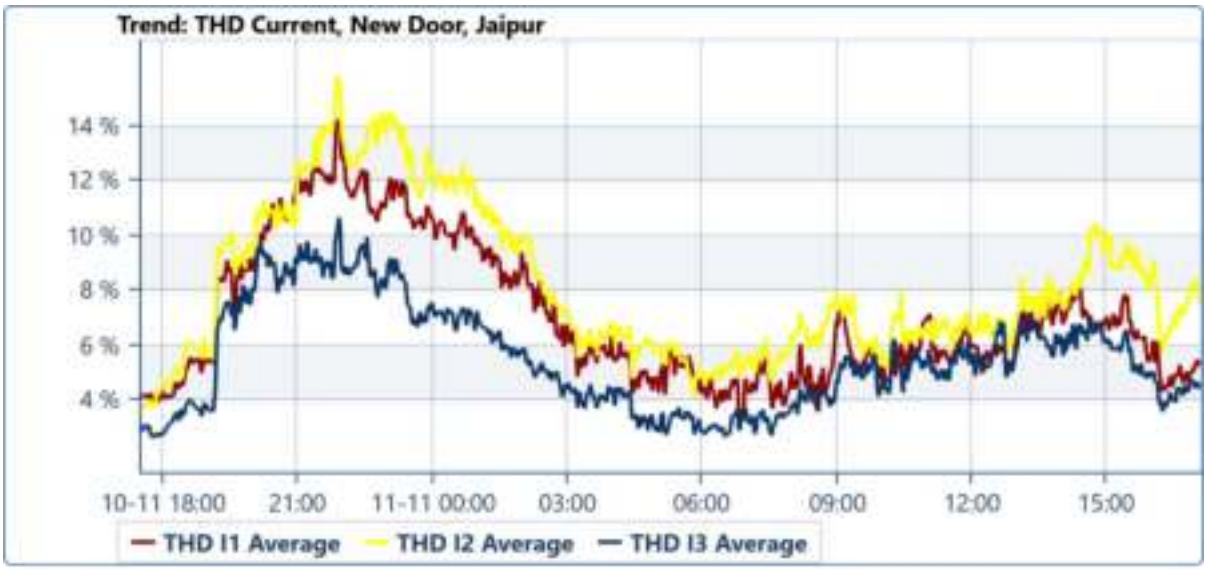
Parameter	Min	Max	Average
Power Factor 1 (Auto)	0.933 CAP	0.896 IND	0.99 IND
Power Factor 2 (Auto)	0.91 CAP	0.92 IND	0.994 IND
Power Factor 3 (Auto)	0.908 CAP	0.93 IND	0.996 IND
Power Factor Total (Auto)	0.921 CAP	0.924 IND	0.993 IND

Trend of THD Voltage, New Door, Jaipur



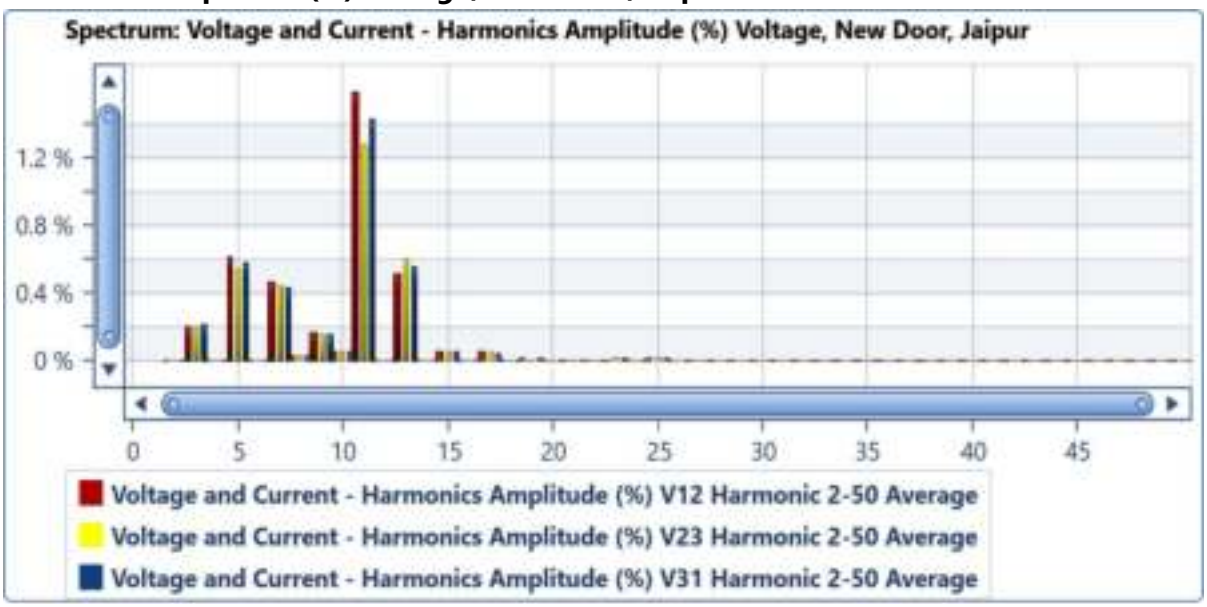
Parameter	Min	Max	Average
THD V12 (Auto)	0.58 %	4.37 %	1.97 %
THD V23 (Auto)	0.35 %	4.62 %	1.71 %
THD V31 (Auto)	0.33 %	5.53 %	1.82 %

Trend of THD Current, New Door, Jaipur

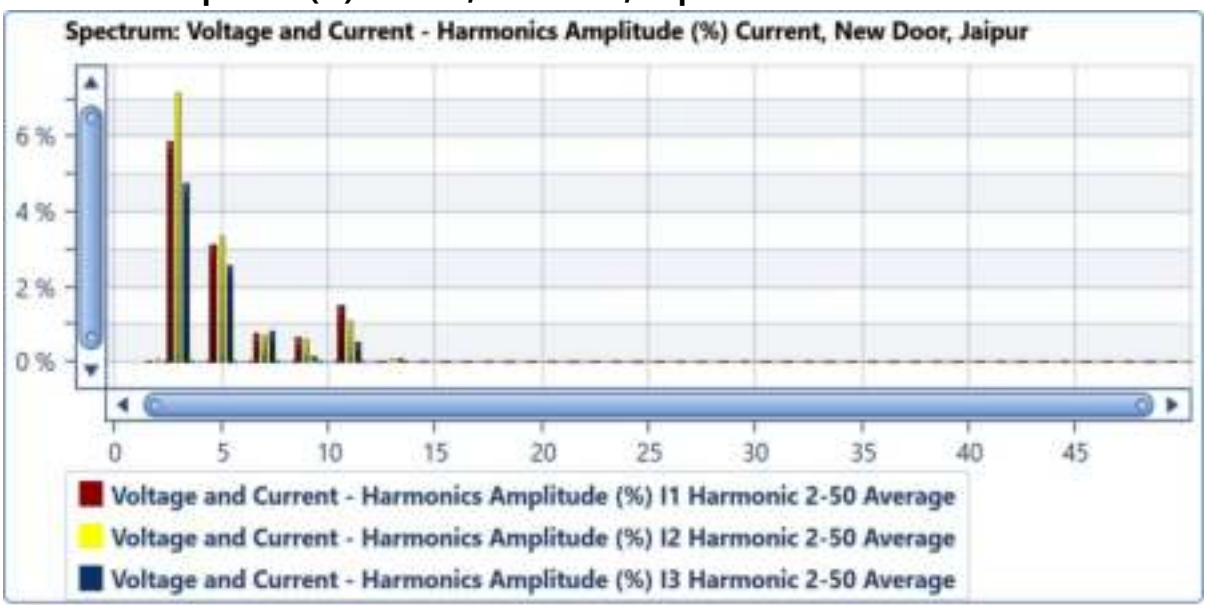


Parameter	Min	Max	Average
THD I1 (Auto)	2.91 %	18.34 %	7.03 %
THD I2 (Auto)	2.99 %	29.04 %	8.14 %
THD I3 (Auto)	2.01 %	30.24 %	5.53 %

Harmonics Amplitude (%) Voltage, New Door, Jaipur



Harmonics Amplitude (%) Current, New Door, Jaipur



4.1.2 APFC HEALTH CHECK-UP:

There are 3 APFC panels in New door for reactive power management.360 KVAr panel with reactor is installed at Transformer-3(3000 KVA), 360KVAr panel with reactor on Transformer-2(1000 KVA) and 240 KVAr panel with reactor is installed at Transformer-1(1000 KVA). Our team conducted health check-up of these panel and the data are given below-

1. APFC Panel -3 of 360 KVAr with reactor on Transformer-3(3000 KVA)

S.NO	CAPACITOR BANK	CAPACITOR RATING	MCB RATING	CONTACTOR RATING	CURRENT			REMARKS
					R	Y	B	
1	1	25	C160, ABB	ACB UA30-30-10RA	28	28.6	29	OKAY
		25			30	31	31	OKAY
		10			13	12.6	12	OKAY
2	2	25	C160, ABB	ACB UA30-30-10RA	32	32.1	32	OKAY
		25			32	32.2	32	OKAY
		10			12	12.1	11	OKAY
3	3	25	C160, ABB	ACB UA30-30-10RA	33	32.2	32	OKAY
		25			34	34.1	32	OKAY
		10				12.2	12	OKAY
4	4	25	C160, ABB	ACB UA30-30-10RA	34	33.7	32	OKAY
		25			35	34.3	32	OKAY
		10			11	11.3	12	OKAY
5	5	15	C80, ABB	ACB UA30-30-10RA	20	19.2	18	OKAY
		15			18	18.2	20	OKAY
6	6	15	C80, ABB	ACB UA30-30-10RA	19	18.2	20	OKAY
		15			20	19.2	19	OKAY
7	7	15	C80, ABB	ACB UA30-30-10RA	21	20.9	20	OKAY
		15			20	20.2	20	OKAY
8	8	15	C80, ABB	ACB UA30-30-10RA	21	21.1	18	OKAY
		15			20	20.3	20	OKAY

Table 8: APFC Summary of Panel-3

2. APFC Panel -2 of 360 KVAr with reactor on Transformer-2(1000 KVA)

S.NO	CAPACITOR BANK	CAPACITOR RATING	MCB RATING	CONTACTOR RATING	CURRENT			REMARKS
					R	Y	B	
1	1	15	C80 ABB	ACB UA 30-30-10R	20	18	20	OKAY
		15			20	18	20	OKAY
2	2	25	C160 ABB	ACB UA 30-30-10R	32	32	32	OKAY
		25			32	32	32	OKAY
		10			12	12.8	13	OKAY

3	3	15	C80 ABB	ACB UA 30-30-10R	20	18	20	OKAY
		15			18	20	18	OKAY
4	4	25	C160 ABB	ACB UA 30-30-10R	32	31	32	OKAY
		25			31	32	31	OKAY
		10			12	12	12	OKAY
5	5	25	C160 ABB	ACB UA 30-30-10R	32	33	32	OKAY
		25			31	32	31	OKAY
		10			12	12	12	OKAY
6	6	25	C160 ABB	ACB UA 30-30-10R				MCB Faulty
		25						
		10						
7	7	15	C80 ABB	ACB UA 30-30-10R	20	18	20	OKAY
		15			20	18	20	OKAY
8	8	15	C80 ABB	ACB UA 30-30-10R	18	20	20	OKAY
		15			20	18	20	OKAY

Table 9: APFC Summary of Panel-2

3. APFC Panel -1 of 240 KVAr with reactor on Transformer-1(1000 KVA)

S.NO	CAPACITOR BANK	CAPACITOR RATING	MCB RATING	CONTACTOR RATING	CURRENT			REMARKS
					R	Y	B	
1	1	15	C80 ABB	ACB UA 30-30-10R	20	18	20	OKAY
		15			18	20	18	OKAY
2	2	25	C160 ABB	ACB UA 30-30-10R	32	32	32	OKAY
		25			32	32	32	OKAY
		10			12	12.8	13	OKAY
3	3	15	C80 ABB	ACB UA 30-30-10R	20	18	20	OKAY
		15			18	20	18	OKAY
4	4	25	C160 ABB	ACB UA 30-30-10R				MCB Faulty
		25						
		10						
5	5	25	C160 ABB	ACB UA 30-30-10R				MCB Faulty
		25						
		10						

Table 10: APFC Summary of Panel-1

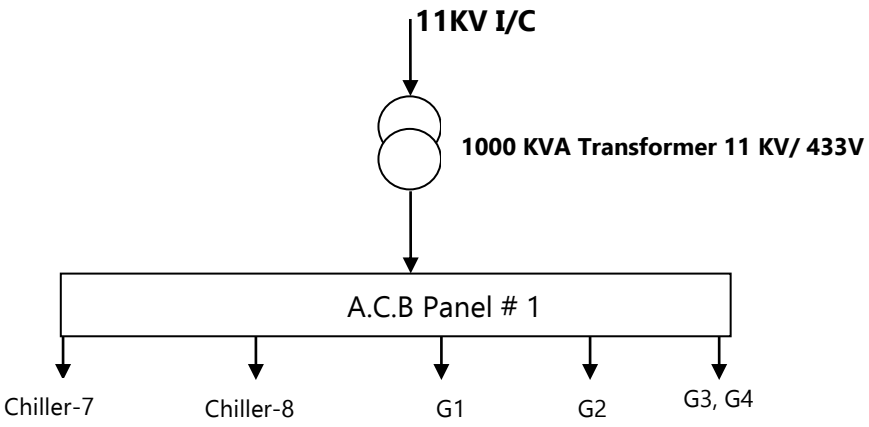
Observation: Some of the MCB are faulty that should be replaced as soon as possible

4.1.3 Saving analysis on Distribution Transformer:

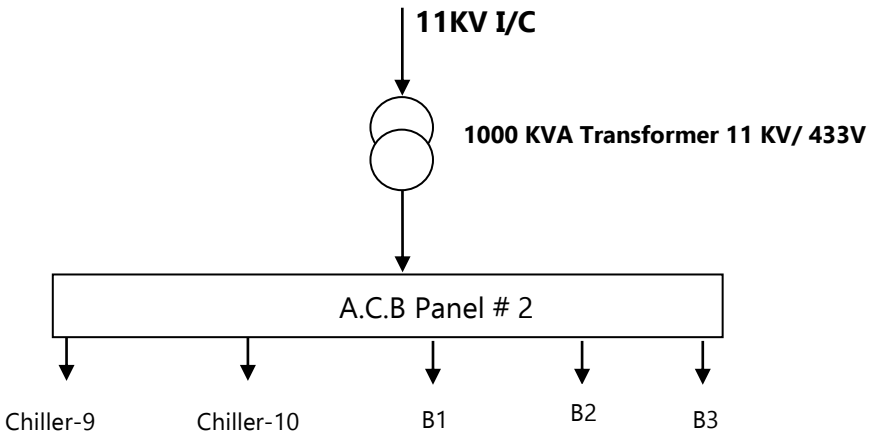
Optimizing capacity utilisation of Transformers to reduce transformer losses: -

1) The incoming supply from grid is coming at 11 KV level, which is stepped down to 433 V level to be supplied at New Door. There are three power transformers: 3000 KVA, 1000 KVA &1000 KVA which are stepping down the potential TO 430/415 volt in 3-phase/ 4-wire circuit. The single line diagram for individual transformer is shown below:

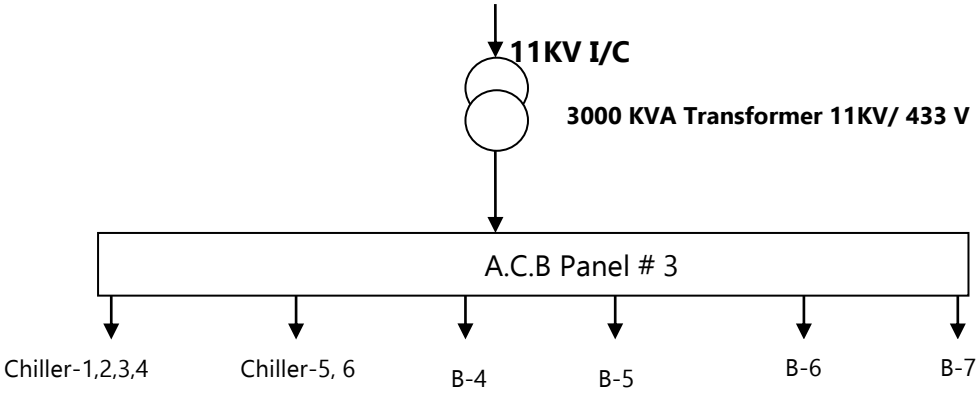
2) Single line diagram for Loads attached with 1000 KVA Transformer (TR#1)



3) Single line diagram for Loads attached with 1000 KVA Transformer (Tr#2)



4) Single line diagram for Loads attached with 3000 KVA Transformer (Tr#3)

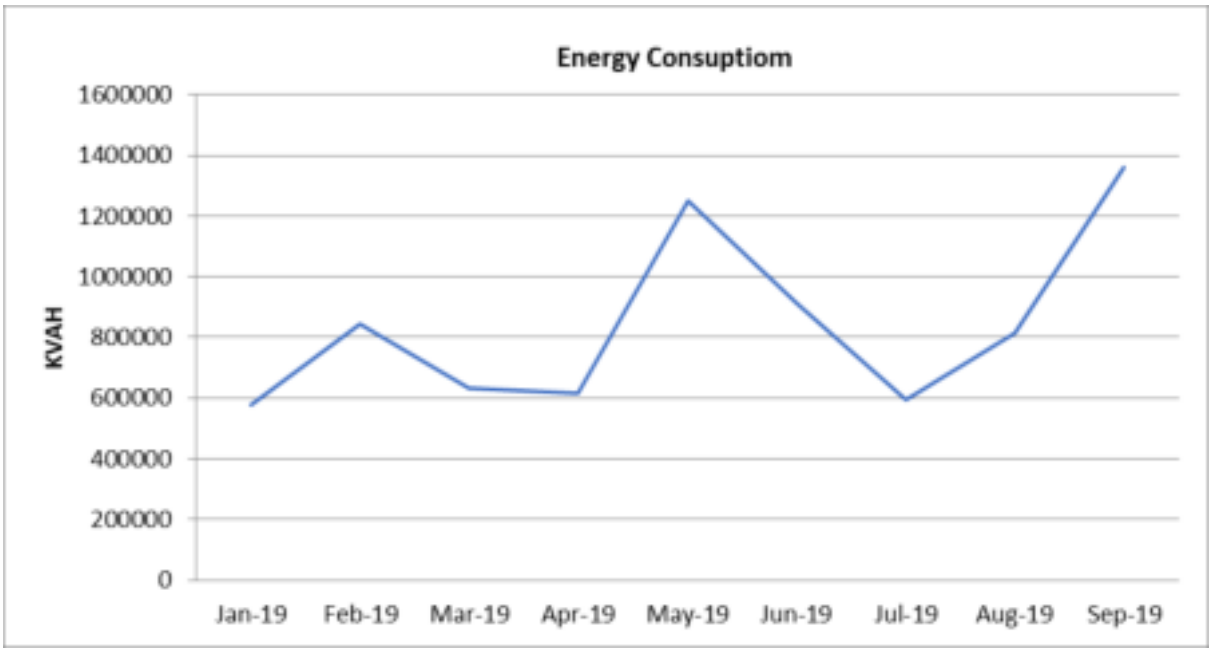


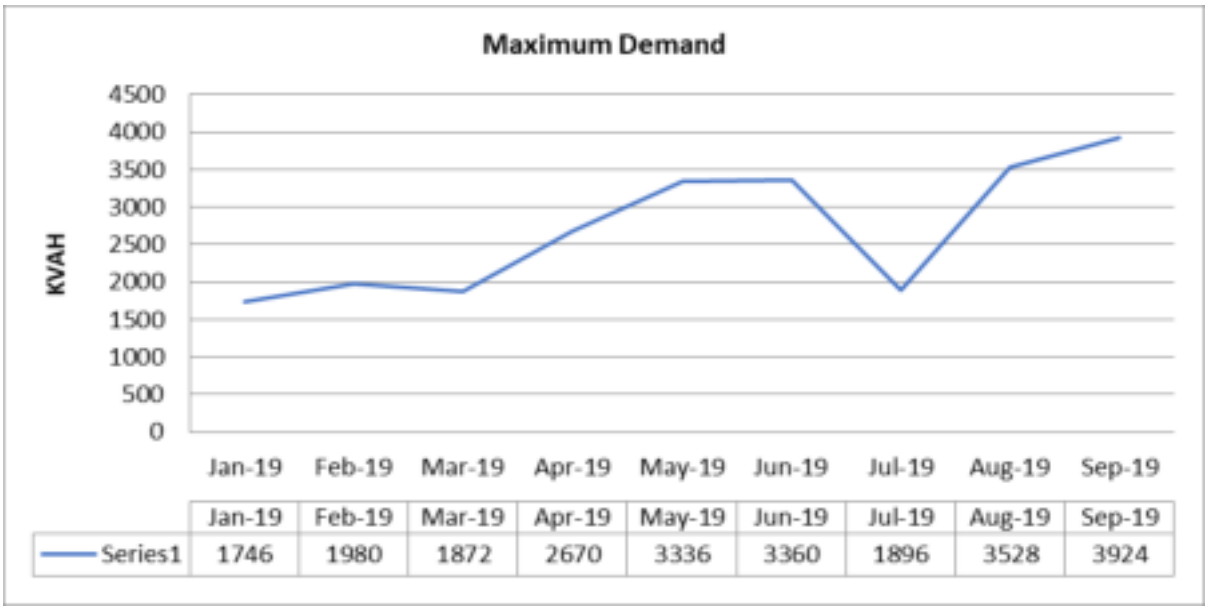
5) Load Details of Transformers: -

S. No	Location	Rating (KVA)	Max. Load KVA	Avg. Load KW	% Loading in KVA	Avg. Load KVA	Avg. Load KW	%Loading in KVA
1	11-kV Main Incomer	5000	1710	1650	34.2	846.01	845.35	16.92
2	Transformer-1	1000	400.31	399.07	40.03	213.18	211.98	21.32
3	Transformer-2	1000	553.94	551.5	55.39	330.28	329.44	33.03
4	Transformer-3	3000	806.44	801.41	26.88	327.96	325.76	10.93

Table 11: Transformer Information

6) Details of Energy Consumed by New Door Hospital during the period Feb-19 to Sept-19: -





7) Analysis of available data: -

i) The figure indicates that on average loading, the transformer-3(3000KVA) is running on 11% loading. The total load connected on transformer-3 is 1800KW (approx.). The loading on transformer-3 is 50% in case of maximum. Load on condition.

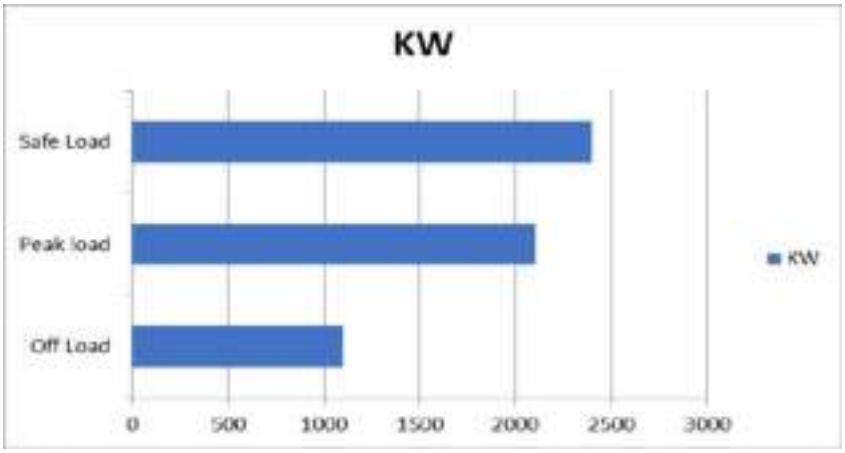
ii)) Transformer-1 is running on 21% average loading. The total connected load on transformer-1 is 600 KW (approx.).

Total Connected Load on Transformer-1

Total Load, including Chiller & Block (G1, G2, G3, G4) – 600 KW (approx.)

Total Load, excluding Block – 300 KW.

3) If we shift the block load (G1, G2, G3, G4) on Transformer-3, it will be total load 2100 kW on transformer-3 which will be 70% loading in case of total connected load is on condition. Another option is to shift the load from transformer -1 to transformer -2 through bus coupler.



1) As per analysis of electricity bill, the maximum demand is in August & September which is due to chiller load. By discarding transformer-1 for remaining month & running chiller load accordingly on rest of transformers. The energy saving analysis is given below: -

S. No	Particulars	UOM	Value
1	Transformer Rating	KVA	1000
2	Min % saving of no-load losses	%	0.3%
3	Unit Loss	KVA	3
4	Operating Hours	Hours	24
5	Operational Days	Days	300
6	Annual Energy saving	KVAh	21818
7	Unit Cost	Rs.	9.4
8	Annual Monetary saving (in Lakhs)	Rs.	2.051
9	Investment (in Lakhs)	Rs.	1.5
10	Payback	Rs.	9

Table 12: Energy saving analysis on Transformer

Note: Load shifting can either be done by shifting the cables or by using Bus coupler.

Standard Philosophy:

1. Shifting of load will be during non-peak seasons.
2. Turn off transformer-1 and operate transformer-2 and 3 during non-peak seasons' July to September.
3. Do not put chiller load on Transformer- 1 or 2 until load on transformer 3 crosses 2200 Kw.
4. After the visit it has been observed that it can be achieved through shifting of cables to the panel which already has provision of some of the loads on 3 MVA transformer

to operate on DG also. Since there is no investment required, therefore there is no need of proposal.

2) As per analysis of power quality, the running voltage at transformer-3(3000KVA) is 430 Volt so by reducing voltage level to 410-415 volts the energy saving that can be achieved is given below-

S. No	Particulars	UOM	Value
1	Annual Energy consumption from transformer 3	KVAH	70,34,760
2	Running Voltage	Volt	430
3	Reduction in Volt	Volt	15-20
4	Saving by voltage reduction annually	%	2
5	Annual Energy saving	KVAh	1,40,695
6	Unit Rate	Rs.	9.4
7	Annual Monetary Saving (in Lakhs)	Rs.	13.23
8	Investment	Rs.	Nil
9	Payback		Immediate

Table 13: Energy saving analysis on Transformer

4.2 HVAC SYSTEM:

4.2.1 CHILLERS:

MUJ Hostel has installed ten chillers (10) of Carrier Make in the premises and have operating max 5 to 6 chillers at a time during peak season (July, Aug, Sep) to cater the cooling load of almost 3000 rooms say at occupancy rate of 70% (average). There are 6 chillers (135 TR each) which can operate in both cooling and heating mode and 4 chillers (270 TR each) which can operate in cooling mode. Performance assessment has been conducted and the results are as mentioned below.

S. No	Particulars	UOM	Values									
1	Chiller		5	6	7	8	9	10	1	2	3	4
2	Make		Carrier									
3	Rated Capacity	TR	135	135	135	135	135	135	275	275	275	275
4	Operating Hours		1000	1000	1000	1000	1000	1000	700	700	700	700
5	Actual Chiller Current	Amp	227	222	225	218	236	233	470	481	410	418
6	Set Point	°C	7	7	7	7	7	7	7	7	7	7
7	Ambient temp	°C	28.7	28.5	28.8	28.8	28.8	28.8	26.1	24.6	24.6	24.3
8	Control Point	°C	6.7	6.7	6.7	6.7	7	7	6.7	6.7	6.7	6.7
9	Cooler entering fluid	°C	23.8	21.2	21	21.3	22	21.9	25.6	23.8	23.2	23
10	Cooler leaving fluid		14.5	14.1	13.4	13.4	13.5	13.6	11.7	13.4	12.9	11.6
11	Delta T	°C	9.3	7.1	7.6	7.9	8.5	8.3	13.9	10.4	10.3	11.4
12	Chiller Tonnage	TR	115	87	94	97	105	102	342	256	254	281
13	Power Consumed	kW	135	132	133	129	141	140	287	292	235	242
14	SPC	kw/ton	1.18	1.51	1.42	1.33	1.35	1.37	0.84	1.14	0.93	0.86
15	COP		2.98	2.33	2.48	2.65	2.61	2.57	4.20	3.09	3.79	4.08
16	Range of Good Performance COP	kw/ton	0.80 to 1.3									
17	Remark		Good	OK	OK	OK	OK	OK	Good	Good	Good	Good

Table 14: Details of Chiller

In descending order Chiller 1,4,3,2,5 are found to be efficient chiller as their COP is near or more than 3. Overall performance of Chillers is found satisfactory though it can be further improved with the help of advanced control systems which may require high capex and will not be feasible owing to a smaller number of operating hours for each chiller. It is to note that Chillers mostly run at evening to dawn, i.e., 14 hrs (max) and we would like to appreciate

the way it is being monitored to control the energy consumption. However, in controlling one has to take caution against too much start/stop of Compressors which will reduce its life.

AUXILIARIES OF CHILLER

FANS

Each chiller is fitted with Fans of 1.5 kW & there are 10 nos in 135 TR chiller unit and 16 nos in 270 TR chiller unit.

Energy Saving in Chillers:

1) Reduce entering water temperature or increase chilled water supply temperature or increase set point temperature

On some building systems, operators can reduce the chilled water set point to overcome air handler deficiencies such as dirty coils. Beware of this practice, which may stop the symptoms but won't cure the problem. It makes the chiller work harder for the same net cooling effect.

For each 1 °C increase in set point temperature can save almost 5% of chiller energy consumption. As Good host is maintaining chilled water temperature around 10 to 11 °C, there are instances in the log when the chilled water temp goes below 9.5 °C. Therefore, there is a strong possibility that these events can occur for at least 10% of the time even after manual control of chiller for start/stop. Hence, consider 10% of saving achievable from potential saving:

S. No	Particulars	UOM	Value
1	Existing Setpoint	°C	6.7
2	Proposed Set Point	°C	10
3	Energy Saving Potential	%	5%
4	Existing SPC of Chiller	kW/TR	1.17
5	Improvement in SPC by 5%	kW/TR	0.06
6	Average Running TR per hour	TR	540
7	Total Energy Saving per hour	kW	32.4
8	Annual Operating hours	hrs	4200
9	Annual Energy saving	kVAh	137454
10	Duration of energy saving potential in a year	%	10
11	Potential energy saving	kVAh	13745.4
12	Unit Cost of Electricity	Rs.	9.4
13	Annual Monetary saving	Rs.	1,29,207
12	Investment	Rs.	Nil
13	Achievable Energy Savings	months	Immediate

Table 15: Energy saving analysis on Chiller

Note:

1) If Cooling capacity is under rated due to low CD then it needs to be increased and not to operate the chiller on inefficient parameters.

2) We have noted down of some logs where it has shown Set point as 6.7 deg C in past too. Please see the attach.

3) Through the same logs and as per your earlier comments also, you told that temp does not reach below 10-11 deg C on any instance. We have seen it through logs also. Accordingly, we had reduced the saving.
4)The logs that are randomly picked by us and not selectively. This saving point is valid based on all above.

2) Free cooling or Chiller free cooling

Use of PLC and Sensor before starting chiller to maintain chiller water supply at required temperature with the help of fans only from all chillers. It involves removing the unwanted heat from the cooling system without the use or with minimal use of the compressors. This isn't possible in all locations it can only be used when the outdoor air temperature is below the chilled water set point temperature.
Using a free cooling allows the chillers compressor to be turned off, however the pumps and fans will still run and will likely run at high speeds so some of the savings from the compressor being off are offset here.
Using a free cooling cycle could reduce the chillers annual energy consumption by 20-50% again this really depends on the local ambient conditions and setpoint temperature.

Alternatively, air cooled condensers can be fitted into the system to use just ambient air to remove as much heat as possible before reaching the chiller.

Implementation: This saving cannot be achieved as communicated to IPPL by Good Host because the operational starting time of the chiller would be in between 4-5 PM for most of the days of the year. Due to it this suggestion is infeasible. However, we suggest to separate the starter of fan and compressor i.e. the fan and compressor should start independently.

3) Chiller plant optimization

With reference to operational logs maintained by Good host the existing SPC for the set of operating chillers is found to be approximately 1.17. Running combination of most efficient chiller in this condition only will give SPC approximately 0.94. However, for conservative estimate we consider SPC as 1. The chiller, cooling towers and pumps all have different efficiency curves especially at part load conditions. A plant sequencer can be used to ensure that the most efficient combination of plant items is used to match the current cooling load. The sequencer can be either just for the chillers or more advanced ones will include all the associated large plant items.
If you opt for the combined plant sequencer then it's possible to reduce the entire systems energy consumption by around 20% sometimes higher but this depends on how bad the controls strategy previously was and how efficient your plant items run at part load. Therefore, running most efficient chiller (1,2,3,4,5) for most of the time will reduce the energy consumption.

S.No.	Particulars	UOM	Value
1	Annual Energy Consumption	kWh	1345181
2	Existing SPC of Chiller	kW/TR	1.16
3	Proposed SPC of Chiller	kW/TR	1.00
4	Improvement in SPC	kW/TR	0.16
5	Average Running TR per hour from other chillers	TR	270
6	Total Energy Saving per hour	kW	43.2
7	Annual Operating hours	hrs	1000
8	Annual Energy saving	kVAh	43636.3
9	Unit Cost of Electricity	Rs.	9.4
10	Annual Monetary Saving	Rs.	4.1
11	Investment	Rs.	Nil
12	Payback	months	Immediate

Table 16: Energy saving analysis on Chiller

Implementation: Good Host must operate set of chillers with best efficiencies referring to Table 14: Details of chiller on page no 55 for most of the days in the year. Though we understand that Good Host also practises this philosophy up to some extent however we still emphasise that this operational strategy should be kept on record and the record should be displayed near the operating panel. This suggestion will save energy in long term.

Note: We have observed through the logs that even you operate with best combination of chillers then the SPC is till high for which this suggestion has been made. Since you operate mostly 2-3 chillers at time sometimes operate 4-5 chillers in peak season. Therefore, it can achieve by enumerate putting 2-3 chillers on both Mains and DG also with necessary changes. And rest of the chillers will remain as they are. We are saying that just select and run the best chillers only in combination.

4.2.2 CHILLED WATER PUMPS:

8 Chilled water pumps are present for circulation of water. 4 Chilled water pumps are operated to match the requirement of the plant and 4 are on standby. We measured the electrical and the flow of these pumps to determine their efficiency and the details are given below-

Figure 7:Chilled water pumps

Sr.no	Particulars	UOM	CWP-1	CWP-2	CWP-3	CWP-4	CWP-5	CWP-6	CWP-7	CWP-8
1	Make		**Armstrong**							
2	Rated Power	kW	37	37	37	37	37	37	37	37
3	Rated P.F		0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
4	Rated Head	m	51	51	51	51	51	51	51	51
5	Rated Flow	m^3/h	148	148	148	148	148	148	148	148
6	Rated Motor Efficiency	%	92.5%	92.5%	92.5%	92.5%	92.5%	92.5%	92.5%	92.5%
7	Measured Head	m	42	42	44	42	42	42	42	44
8	Velocity	m/s	0.931	0.921	0.942	0.941	0.926	0.943	0.929	0.961
9	Pipe Size	mm	870	870	870	870	870	870	870	870
10	Calculated flow	m^3/h	201.9	199.7	204.3	204.0	200.8	204.5	201.4	208.4
11	Measured Flow	m^3/h	183.9	183.5	186.1	185.6	184.5	184.2	183.3	183.8
12	Measured Motor Loading	%	26%	27%	26%	26%	24%	25%	25%	26%
13	VFD	Hz	35	35	35	35	35	35	35	35
14	Measure Hydraulic Power	kW	6.01	6.00	7.10	6.07	6.03	6.02	5.99	7.01
15	Measured Power	kW	12.8	13.1	13	13	12.0	12.2	12.3	12.6
16	Pumping	%	47.0%	45.8%	54.6%	46.7%	50.5%	49.3%	48.6%	55.7%

	Efficiency									
17	Motor Efficiency@30% loading	%	75%	75%	75%	75%	75%	75%	75%	75%
18	Pump Efficiency	%	62.6%	61.1%	72.8%	62.2%	67.3%	65.7%	64.8%	74.2%
19	Remarks		Efficient System							

Table 17: Details of Chilled Water Pumps

Remark: Overall Pumping system efficiency is found good.

4.2.4 UNITARY AC SYSTEM:

New door uses mainly uses Spilt AC for human cooling in areas such as Facility block, Common area and guest rooms. Our team measured different parameters to calculate the efficiency of the split AC's on 20% sample basis. Below given is our findings:

Sr.no	Location	Make	Capacity (TR)	Measured TR	Kilowatt	Kw/TR	Remark
1	B2 Common area	Carrier	1	0.74	0.72	0.97	Efficient
2	Reception	Carrier	1.5	1.01	1.14	1.13	Efficient
3	G1 Common Area	Carrier	1.5	1.35	1.13	0.83	Efficient
4	Login	Vestar	1.5	0.84	1.16	1.37	Inefficient
5	Login	Carrier	1.5	0.99	1.17	1.18	Efficient
6	Medical Centre	Toshiba	2	1.44	1.60	1.12	Efficient
7	Medical Centre	Toshiba	2	1.31	1.57	1.19	Efficient
8	Medical Centre	Toshiba	2	1.50	1.67	1.11	Efficient
9	B1 Guest Room	Carrier	1	0.73	0.70	0.96	Efficient
10	B1 Guest Room (506)	Carrier	1	0.61	0.61	0.99	Efficient
11	B1 Guest Room (505)	Carrier	1	0.55	0.69	1.25	Efficient
12	B1 Guest Room (511)	Carrier	1	0.88	0.79	0.90	Efficient
13	B1 Guest Room (510)	Carrier	1	0.65	0.67	1.04	Efficient
14	Girls Common Area	Carrier	1	0.71	0.68	0.95	Efficient
15	Chief warden office	Carrier	1	0.89	0.77	0.87	Efficient
16	G1 Guest Room (502)	Carrier	1	1.11	0.69	0.62	Efficient
17	G1 Guest Room (505)	Carrier	1	1.15	1.29	1.12	Efficient
18	G1 Guest Room (504)	Carrier	1	0.85	0.74	0.87	Efficient
19	G1 Guest Room (507)	Carrier	1	0.46	0.63	1.38	Inefficient
20	Mr Bharat Bushan Room	Carrier	1.5	1.04	1.16	1.12	Efficient
21	Office area	Carrier	1.5	1.06	1.12	1.05	Efficient
22	Conference area	Carrier	1.5	1.30	1.18	0.91	Efficient
23	Mr Ranjay Verma	Carrier	1	0.89	0.66	0.74	Efficient
24	Recreational Room	Toshiba	6	4.12	4	0.97	Efficient

Table 18: Details of AC

The average EER of the window ac is 2.36 which is low compared to 3-star Ac's EER 3.50 in the market. For energy saving is AC we suggest:

1. Maintain the set point between 24^{O}C to 27^{O}C.
2. Prevent Air Leakage from the envelops.
3. Replace Non star rating ac with new energy efficient inverter ac. The payback period will be 2 to 3 years depending on the operating hours of the AC's.

1) Install automation system in AC's to control the compressor off/on cycle by Automation. The energy saving analysis is captured below table:

Sr.no	Parameters	UOM	Value
1	Average kW/TR	kW/TR	1.3
2	Energy saving Potential	%	20
3	No of units	No	16
4	Operating hours	Hours	8
5	Annual operation days	Days	240
6	Annual Energy saving	KVAh	7987.2
7	Unit rate	Rs/unit	9.4
8	Annual Monetary Saving	Rs	0.7508
9	Investment	Rs	1.2
10	Payback period	Months	19.2

Table 19: Energy Saving Analysis of AC

2) We suggest to replace Inefficient AC by 5-star Inverter AC. Given below is the analysis table

Sr.no	Parameters	UOM	Value
1	Energy consumption per hour by old AC	kWh	1.4
2	Energy consumption per hour by new Inverter AC	kWh	0.9
3	Diff. in energy consumption	kWh	0.5
4	Operating Hours	Hours	8
5	Annual operation days	Days	240
6	No of units to be replaced	No	4
7	Annual energy saving	KVAh	3840
8	Unit Rate	Rs.	9.4
9	Annual monetary saving	Rs.	0.36096
10	Investment	Rs	1.2
11	Payback	Months	40

Table 20: Energy Saving Analysis of AC

4.2.5 AIR HANDLING UNIT (AHU):

Total 2 nos of Air handling units are present in the facility. The performance assessment of the AHU's are illustrated below table:

Sr.no	Location	Rated CFM	Rated kW	Measured kW	Measured CFM	Remark
1	Gym-Outside	12500	5.5	3.4	12688.2643	Satisfactory
2	Gym-Inside	12500	5.5	2.3	10886.6226	Satisfactory

Table 21: Performance assessment of AHU's

1) Energy saving achieved by installation of ZERAX and EC$^+$ System

In HVAC System, EC$^+$ Concept facilities design of topmost efficient AHU's and boost energy efficiency of the existing systems. The concept prescribes components for optimum system design of high efficiency fans, high efficiency IE4 motors and high efficiency Danfoss VFD's. The combined system has the potential to deliver efficiencies in the range of 80 - 85%, which is 15% – 25% points better than the closest alternative solutions such as direct-driven centrifugal plug fans with EC motors. The payback period of the system will come 3 to 4 years.

4.2.6 COLD STORAGE/ROOMS:

Sr.no	Location	DB	RH	Return grill	Supply grill	RH	Area of indoor unit			TR	SP	KW	kW/TR	Reqd TR
							2 Fan	3 Fan	Room Volume					
							(in m^2)	(in m^2)	(in m^3)					
1	Cold Room-I	11.6	89	11.6	14	90	0.42	0.525	30.64	5.7	11	8.1	1.41	5.2
2	Cold Room-II	12	81	11	15	85		0.525	19.58	5.4	11	7.1	1.31	4.9
3	Cold room-III	5	70	6.5	8	81	0.42		20.39	3.1	7	4	1.3	2.7
4	Deep Cold room	-3.5	50	-5	-3	85		0.525	13.01	3	-13	3.5	1.14	2.6

Table 22: Performance assessment of cold room unit

Overall Performance of the Cold room indoor unit are found to be satisfactory.

4.3 Water Survey

WATER BILL ANALYSIS

Months	Purchased (in KL)	Amount (in Rs)	Rs. /KL
Jan-19	3537	871804	246
Feb-19	3378	823980	244
Mar-19	2635	671310	255
Apr-19	3521	897208	255
May-19	2995	711311	237
Jun-19	609	142840	235
Jul-19	648	152080	235
Aug-19	3315	821000	248
Sep-19	3468	871280	251
Oct-19	3003	756975	252
Estd. Annual Expenditure	32531	80,63,745	246

WATER BALANCE DIAGRAM

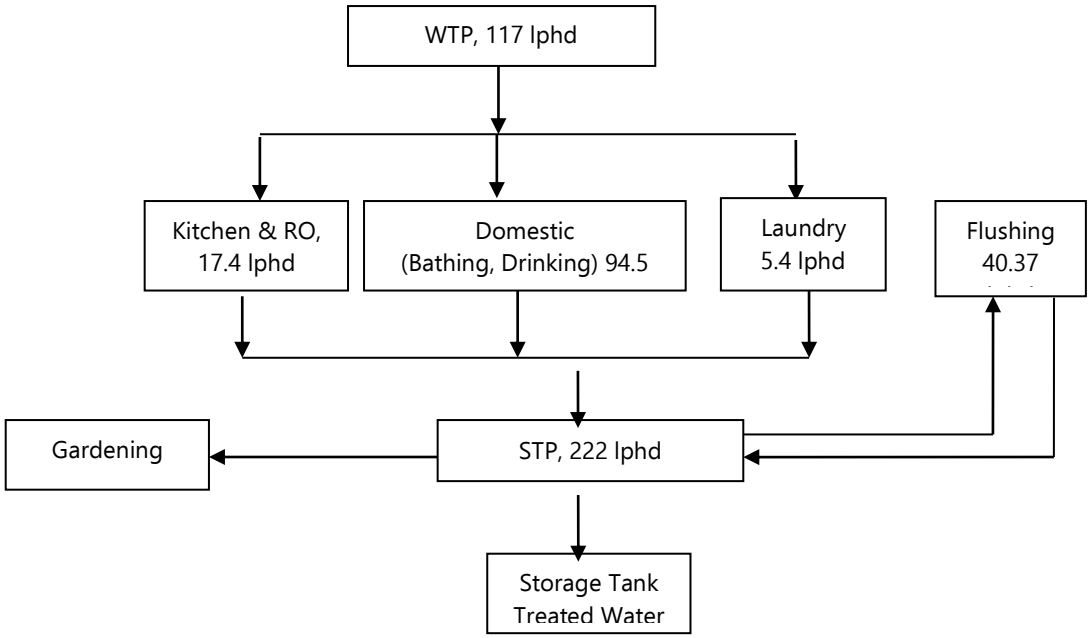


Figure 8:Water Balance Diagram

S.No	Particulars	UOM	Values
1	WTP	lphd	117.3
2	STP	lphd	222.2
3	Domestic	lphd	94.5
4	Laundry	lphd	5.4
5	Kitchen	lphd	13.7
6	Retail Outlets	lphd	3.7
7	Flushing	lphd	40.4

TOTAL WATER CONSUMPTION

S. No	Consumption	UOM	No. of Rooms	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	B1-Zone 1	lphd	147	133	166	145	181	146	34	80	181	175	184	136	109
2	B1-Zone2	lphd	212	170	214	172	222	161	38	68	225	222	232	173	134
3	B1-Zone 4	lphd	116	92	114	98	120	95	24	32	112	116	125	89	70
4	B2-Zone 1	lphd	127	87	109	103	133	82	28	30	153	108	108	84	74
5	B2-Zone2	lphd	205	146	185	170	208	142	28	46	212	183	185	139	107
6	B2-Zone 3	lphd	98	88	92	85	116	80	11	11	124	128	112	89	61
7	B3-Zone A	lphd	118	83	96	61	71	62	48	69	94	107	109	75	76
8	B3-Zone B	lphd	90	47	59	48	50	41	28	29	53	73	66	43	56
9	B4	lphd	241	169	149	121	115	103	60	90	218	242	251	192	173
10	B5	lphd	111	118	125	113	153	166	20	47	201	188	199	151	144
11	B6	lphd	276	195	184	205	210	216	99	105	267	256	279	223	217
12	B7	lphd	364	328	414	350	417	305	94	101	453	376	437	292	226
13	G1 -Zone 3	lphd	167	110	121	110	110	121	55	56	219	146	154	107	114
14	G1-Zone 4	lphd	167	151	165	155	172	151	36	58	199	166	224	162	152
15	G2	lphd	163	153	159	147	184	146	21	24	221	217	229	168	123
16	G3	lphd	171	144	168	144	150	111	18	40	108	150	181	139	117
17	G4	lphd	173	77	25	6	2	85	66	83	174	158	150	121	140
18	Total	lphd		2288	2547	2233	2615	2213	708	967	3214	3011	3226	2384	2093
19	Average Consumption per head , lphd			135	150	131	154	130	42	57	189	177	190	140	123
20	Annual Average Consumption per head, lphd			138.37											

As per CGWA and NBC 2016, the water consumption per head is given as 135 lphd for Hostel Category. Therefore, overall water consumption of Hostel is found satisfactory.

DOMESTIC WATER CONSUMPTION

S. No	Consumption	UOM	No. of Rooms	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	B1-Zone 1	lphd	147	133	166	145	181	146	34	80	181	175	184	136	109
2	B1-Zone2	lphd	212	170	214	172	222	161	38	68	225	222	232	173	134
3	B1-Zone 4	lphd	116	92	114	98	120	95	24	32	112	116	125	89	70
4	B2-Zone 1	lphd	127	87	109	103	133	82	28	30	153	108	108	84	74
5	B2-Zone2	lphd	205	146	185	170	208	142	28	46	212	183	185	139	107
6	B2-Zone 3	lphd	98	88	92	85	116	80	11	11	124	128	112	89	61

7	B3-Zone A	lphd	118	83	96	61	71	62	48	69	94	107	109	75	76
8	B3-Zone B	lphd	90	47	59	48	50	41	28	29	53	73	66	43	56
9	B4	lphd	241	169	149	121	115	103	60	90	218	242	251	192	173
10	B5	lphd	111	118	125	113	153	166	20	47	201	188	199	151	144
11	B6	lphd	276	195	184	205	210	216	99	105	267	256	279	223	217
12	B7	lphd	364	328	414	350	417	305	94	101	453	376	437	292	226
13	G1 -Zone 3	lphd	167	110	121	110	110	121	55	56	219	146	154	107	114
14	G1-Zone 4	lphd	167	151	165	155	172	151	36	58	199	166	224	162	152
15	G2	lphd	163	153	159	147	184	146	21	24	221	217	229	168	123
16	G3	lphd	171	144	168	144	150	111	18	40	108	150	181	139	117
17	G4	lphd	173	77	25	6	2	85	66	83	174	158	150	121	140
18	Total	lphd		2288	2547	2233	2615	2213	708	967	3214	3011	3226	2384	2093
19	Average Consumption per head , lphd			135	150	131	154	130	42	57	189	177	190	140	123
20	Annual Average Consumption per head, lphd			94.5											

FLUSHING WATER CONSUMPTION

S. No	Consumption	UOM	No. of Rooms	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	B1-Zone 1	lphd	147	109	133	111	147	98	32	49	135	132	145	113	89
2	B1-Zone2	lphd	212	122	155	119	163	96	25	36	137	144	151	107	84
3	B1-Zone 4	lphd	116	55	74	56	75	44	4	8	58	67	75	53	43
4	B2-Zone 1	lphd	127	49	73	63	92	51	18	8	78	45	58	36	29
5	B2-Zone2	lphd	205	100	131	116	154	84	4	18	125	100	111	80	57
6	B2-Zone 3	lphd	98	71	75	67	92	50	6	7	74	79	77	64	40
7	B3-Zone A	lphd	118	59	74	44	54	38	20	30	55	79	81	55	51
8	B3-Zone B	lphd	90	36	45	25	23	22	16	17	34	46	47	26	38
9	B4	lphd	241	125	119	97	93	73	35	61	149	183	196	150	130
10	B5	lphd	111	95	100	85	118	100	17	32	123	141	149	118	107
11	B6	lphd	276	136	141	130	144	112	40	39	172	186	205	160	149
12	B7	lphd	364	231	263	240	300	182	67	62	253	221	269	198	154
13	G1 -Zone 3	lphd	167	110	121	110	121	110	61	33	147	146	154	107	110
14	G1-Zone 4	lphd	167	108	123	113	140	94	20	30	137	129	140	106	97
15	G2	lphd	163	107	114	100	135	87	20	18	132	143	157	117	87
16	G3	lphd	171	144	168	144	166	100	20	40	108	150	181	139	113
17	G4	lphd	173	60	21	3	1	43	40	47	106	114	113	88	96
18	Total	lphd		1715	1932	1624	2018	1383	445	534	2021	2104	2307	1717	1476

19	Average Consumption per head lphd	101	114	96	119	81	26	31	119	124	136	101	87
20	Annual Average Consumption per head, lphd	40.37											

Flushing requirement of hostel (45 lphd) is being fulfilled by STP treated water which means the actual consumption of water would be 98 lphd for hostel from outside resources and rain water.

Water Saving Potential

1) Increasing Re-use of grey waste water after separate treatment with UV disinfectant, Chlorination and other technology available and mixing 50% with fresh water into Laundry, Dish washing or Chilled water application will further reduce the fresh water consumption resulting into saving of Rs 9.76 lacs and 4000 KL per year. As the treatment of waste grey water from Block is very tedious it is suggested to treat the grey water of laundry.

2) Flushing water can be reused for same tank if stored for less than 1 hour. In case, there is no reuse of stored waste water in tank, it can be discard flushed toward STP. It will reduce the load on STP and waste water generation.

3) We observed by surveying the area that many water leakages were present. Further water saving can be achieved by arresting water leakages.

Figure 9: Images of water wastage around the facility

4.4 STP

MUJ hostel has 2 no's of STP installed of 350 KLD and 1 MLD capacities to cater the need of treating sewage water generated from buildings.

. The oxygen allows bacteria in a fermentation process to digest the food source (the sewage). These processes break down the waste and reduce it, so that it can settle in clarifiers or get filtered by membranes in a last stage of treatment, before being returned as final effluent into the environment. Originally the method was mechanical and worked well for decades. Atmospheric air or even pure oxygen was injected or mixed with the liquor in the reactor, followed by mechanical stirring. More recently, the air diffusing concept developed, enabling us to distinguish between coarse bubbling systems (with a bubble size of 5-10mm diameter) with typical AOR/SOR (or AOTE/SOTE) of 0.50 and fine bubble diffusing (FBD) systems with 0.33. Fine bubble diffusers are all about satisfying the needs of the wastewater and sewage treatment industry, in order to achieve an efficient mass transfer of oxygen to the water, particularly that with a suspension of active sludge in a biological reactor. The industry evolved to reach the point where we can now speak about ultra-fine bubbles. The main way of evaluating the operational expenses (OPEX) of the technology is by using the aeration efficiency (AE). This figure is a ratio between how many kilos of O2 can be transferred into wastewater by using 1 kWh of electrical energy, at the required desired dissolved oxygen levels (usually 2mg/l). Typically, 80% of the energy consumption of a treatment plant goes to the blower station in the process of air-feeding the aeration reactors. Energy also goes into inefficient mechanical aeration devices, usually installed only for the sake of reduced CAPEX some years ago. Due to better efficiency of oxygen transfer of fine bubble, the requirement of air to be blower is reduced and hence the size of blower which in turn reduces power consumption resulting into energy savings.

They are many types and shapes of fine bubble diffusers. They have evolved according to the market's needs and include:

• Ceramic diffusers. Made of ceramic porous material, with a dome structure. Air is blown to a bottom mounted grid, diffused through the ceramic pores into water. Although they have high resistance to corrosion, they are very prone to clogging.

• Floor covering panels with flexible polyurethane or silicone membranes. Very high efficiency and long life, but heavy in weight and difficult to manipulate and replace.

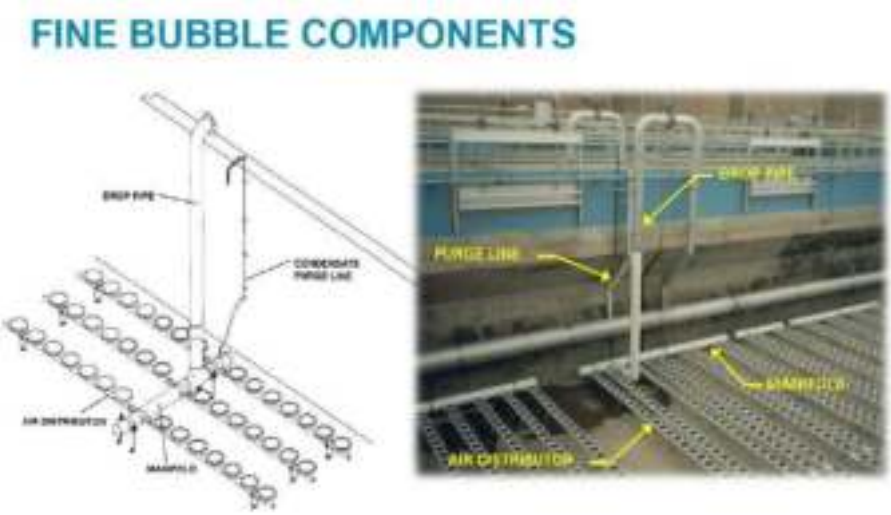
• Flexible EPDM membranes of any shape, from disc to flat surface and tubes. Very low CAPEX, but short membrane life.

• Flexible polyurethane or silicone membranes, on extremely flat stripes, as floor covering. Higher CAPEX, but low OPEX. Long membrane life.

It may be that the approach focused on the diffusers themselves and not on the whole assembly, being the blower station, pipe work, headers, manifolds, diffusers and process automation.

Advantages of Fine Bubble Diffusers

- Highest oxygen transfer efficiency
- Roughly 2% SOTE per foot submergence
- 4 - 7 kg oxygen/kW
- Minimal maintenance, includes hosing off diffusers
- Every 2-3 years
- Membrane life is 8 - 10+ years



S. No.	Parameters	UOM	350 KLD	1 MLD
1	Waste water inflow	m^3/day	350.00	1049.00
2	Total BOD load	mg/l	100	100
3	BOD load in tank	kg/hr	35.0	104.9
4	For 1 kg of BOD removed 1.5 kg of oxygen is required	kg/kg	2	2
5	Density of air		1.17	1.17
6	Oxygen in air		21%	21%
7	Alpha factor		0.65	0.65
8	Beta factor		0.9	0.9
9	Existing Operating kW of the Blower	HP	13	15
10	Therefore, Air required	m^3/day	5411	10426
11	Aeration time	hrs	24	24
12	Therefore, air required	m^3/hr	225	434
13	Air required	CFM	146	281
14	Aeration Tank Depth (including free drop of pipe and distribution pipes, valve's throttle back pressure which you have fitted in the distribution line)	kg/cm^2	0.55	0.55
15	Existing Oxygen transfer efficiency		9%	14%
16	Proposed Oxygen transfer efficiency of fine bubble technology		25%	25%
17	New Operating kW of blower	HP	5	13
18	Potential Energy Savings	kW	6	1

19	Annual Operating hours	hrs	6000	6000
20	Annual Energy Savings	kWh	38400	6061
21	Cost of Electricity	Rs./kVAh	9.4	9.4
22	Annual Monetary Savings	Rs.	368327	58132
23	Investment	Rs.	500000	Nil
24	Payback	months	16	Immediate

Table 23: Energy saving analysis in STP

Note: For 1 MLD STP:

For 1MLD as per discussion with Good host and the comments from OEM, it is noted that the aerator tank already has fine bubble diffuser in it. However, the calculation shows AOTE is low which means either the diffusers are clogged or the aerator blowers are overdesigned as system is not running under full load condition that is 1 MLD which is evident from the log as well where it is reflected for most of the time system is running at part load for most of the days in the year. System runs under full load condition for Peak periods which may be rainy season etc. Therefore, it is recommended to check both of this. In case of blower is overdesigned it is suggested to control the blower through VFD by further reducing frequency. If the diffusers are clogged then we suggest to clean them at once and reduce the frequency as well.

For 350 KLD:

As it is older and there is no information about the diffuser from Good Host as well as OEM, it is suggested to replace the existing diffuser.

ECO STP

Most STPs in use in India today work with aerobic bacteria. This requires the continuous use of air and hence regular power is required to operate the STP. An ecoSTP, on the other hand, works with anaerobic bacteria, which do not require any oxygen or power to function. Hence, it cleans water in a natural and chemical-free manner. The unique ecoSTP technology does not use chemicals or energy to treat the water. Instead, it mimics the processes of the natural world — using a combination of microorganisms, plants and gravel to clean sewage water and return clean water back to mother earth, completing the 'cradle to cradle' sustainable lifecycle.

Unlike motor-based STP's which are not sustainable, ECOSTP is a completely sustainable solution. The table below highlights few of the key differences:

How are we different?	
MOTOR BASED STP's	**ECOSTP**
ENERGY INTENSIVE (POWER NEEDED)	ZERO POWER
BACKUP GENSET + DIESEL	NO GENSET + NO DIESEL
MOTORS + BLOWERS + FREQUENT OIL CHANGE	NO MOTORS
24x7 HUMMING NOISE	NO NOISE
EXHAUST FANS - RISK IF IT IS OFF	NO EXHAUST FANS
CHEMICALS (UREA ETC.)	NO CHEMICALS
SAFETY RISK - OPEN TANK	NO RISK - SEALED TANK
SLUDGE REMOVAL - DAILY/WEEKLY	SLUDGE REMOVAL - ONCE IN 2 YEARS
SLUDGE PATHOGEN RISK	NO MANUAL HANDLING - NO RISK
24x7 MAINTENANCE - SKILLED STP OPERATOR	NO OPERATOR REQUIRED
DEDICATED STP SPACE	SPACE CAN BE REUSED
MLSS MONITORING - NEED TO ADD BACTERIA HOURLY!!!	ONE TIME BACTERIA ADDITION
STP LIFE - 3-5 YEARS (KEEP BUYING SPARES)	ONCE DONE - FOR GENERATIONS
STRONG ODOUR	SEALED - NO ODOUR
STP CAN BE ACCIDENTALLY SWITCHED OFF	CANNOT SWITCH OFF
30% MINIMUM LOAD TO OPERATE	ONLY 1 TOILET TO OPERATE
CRISIS MANAGEMENT (YOUR TIME)	PEACE OF MIND

Product Description (Cow's Stomach Engineering)

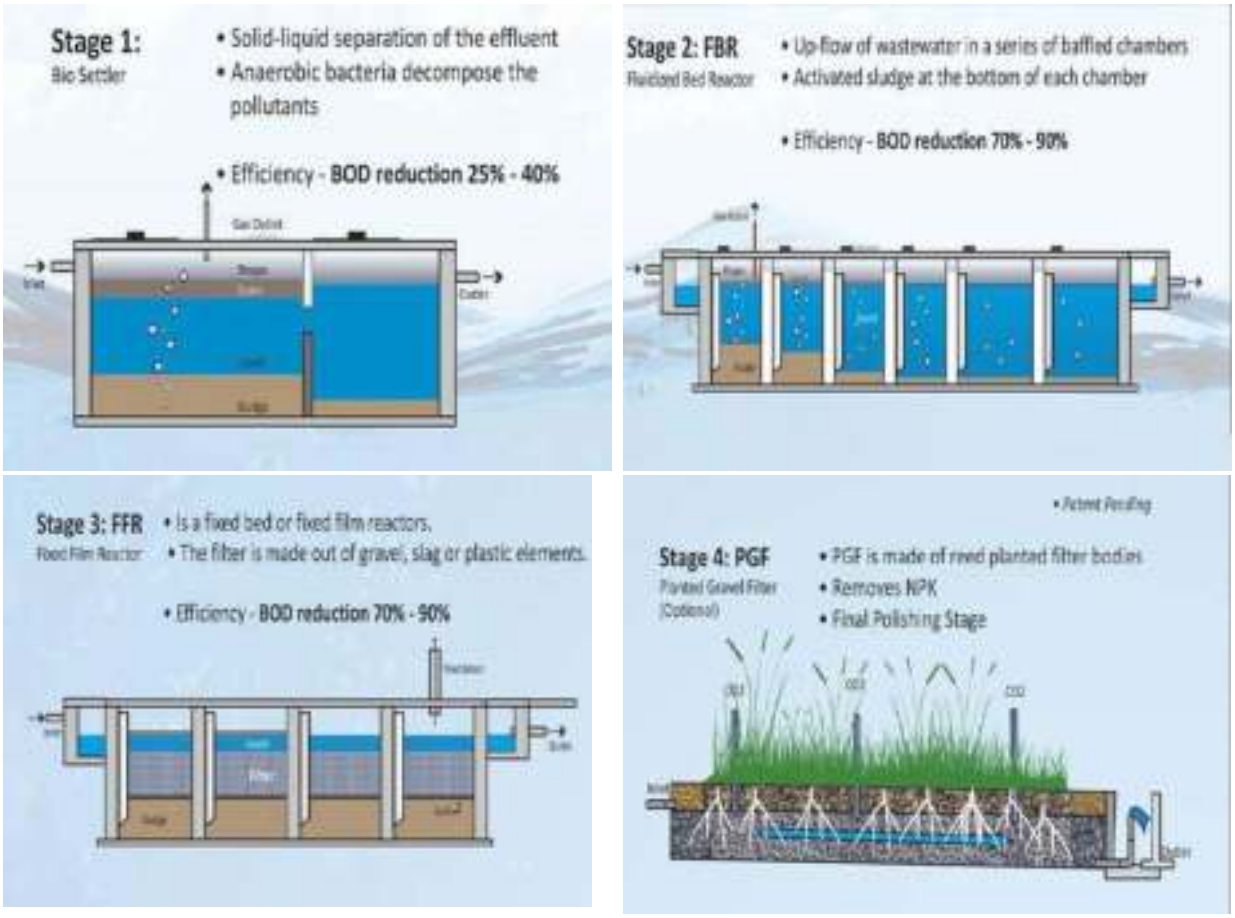


Figure 10:EcoSTP Working

Replacing 350 KLD STP with EcoSTP of 250 KLD

Sr. No.	Parameters	UOM	Value
1	Average Electrical Load of STP plant 350 KLD	kWh/day	480
2	Annual Operating Days	days	360
3	Annual Energy Consumption	kWH	172800
4	Cost of Electricity	Rs./kVAh	10
5	Additional Energy Consumption by Pump	kWh	30240
6	Annual Monetary Savings	Rs.	1425600
7	Investment	Rs.	10000000
8	Payback	months	84.2

Table 24: Energy saving analysis in STP

Implementation: As this suggestion is economically infeasible and requires high effort, we recommend this when there will be a need for new installation.

Optimization of Compressors in STP

FAD test conducted for reciprocating compressors installed in both STP & the results are as given below.

Sr. No	Particulars	UOM	Compressor No 1, 1 MLD	Compressor No 2, 350 KLD
1	Rated FAD	CFM	14.5	6.8
2	Rated KW	KW	4.2	2.6
3	Motor Efficiency	%	90%	85%
4	Make		ELGI	ELGI
5	Initial Pressure	Kg/cm^2	5	5
6	Final pressure after filling	Kg/cm^2	12	10
7	Atmospheric Pressure	Kg/cm^2	1	1
8	Storage Volume	m^3	0.22	0.16
9	Time Taken to build initial pressure to Final Pressure	min	4.8	6.50
10	Compressor output	m^3/min	0.3	0.1
11	Measured KW	kW	4.5	2.3
12	Compressor output	CFM	11	4.3
13	Rated SPC	kW/CFM	**0.319**	**0.433**
14	Measured SPC	kW/CFM	**0.397**	**0.529**
15	Remark		OK	NOT OK

Table 25: Compressor analysis in STP

Performance of small reciprocating compressor of 350 KLD is found not OK. But there is no feasibility in replacing them as their operating hours is very less. However, using following strategy will reduce its energy consumption.

1) Combining the Air distribution for both the STP and fulfilling the pneumatic demands of plants through operating 1 MLD compressor only.
2) Reducing Compressed Air from 12 kg/cm^2 to 10 kg/cm^2 will save energy.

S. No	Particulars	UOM	Values
1	Air Demand by 1 MLD plant in a day	CFM	109
2	Air Demand by 350 KLD plant in a day	CFM	26
3	Power Consumed in a day by 1 MLD	KWh	43.2
4	Power Consumed in a day by 350 KLD	KWh	13.8
5	Total Power Consumed in a day	KWh	57.0
6	Total Power Consumed in a day after combining air distribution	KWh	54
7	Daily Energy Savings	KWh	3.4
8	Annual Energy Savings (I)	KWh	1252
9	Annual Energy Saving due to Reduction in Pressure from 12 to 10 kg (II)	KWh	2337
10	Annual Energy Savings (I+II)	KVAh	3625.3
11	Annual Monetary Saving	Rs	33735
12	Investment	Rs	50000
13	Payback	months	18

Table 26: Energy saving analysis in STP

S. No	Detail	Rated Parameters					Measured Parameters				
		KW	Efficiency	Capacity (m^3/hr)	Pressure (kg/cm^2)	Blower Efficiency	PF	KW	Flow, m3/hr	Efficiency	Freq
1	STP Blower-1 1 MLD	22	91.6	866	0.5	54%	0.84	11	271	34%	35
2	STP Blower-2 1 MLD	22	91.6	866	0.5	54%	Standby				
3	STP Blower-3 1 MLD	11	89.8	351	0.55	48%	0.78	10.2	324	48%	
4	STP Blower-4 1 MLD	11	89.8	351	0.55	48%	Standby				
5	STP Blower-5 1 MLD	11	89.8	276	0.45	31%	Standby				
6	STP Blower- 6 1 MLD	11	89.8	276	0.45	31%	0.81	9.6	277	35%	
7	STP Blower-7 350 KLD	11	89.8	862	0.55	Incorrect Config	0.85	9.9	324	49%	
8	STP Blower-8 350 KLD	11	89.8	862	0.55	Incorrect Config	Standby				
9	STP Blower-9 350 KLD	7.5	88.5	278	0.5	50%	0.82	6.3	184	40%	10.5

10	STP Blower-10 350 KLD	7.5	88.5	862	0.5	Incorrect Config	0.82	5.4	153	38%	

Table 27: Details of blowers in STP

Overall performance of blowers is found satisfactory. Though incorrect practices have been identified as for high capacity of blowers are coupled with low motor rating than required

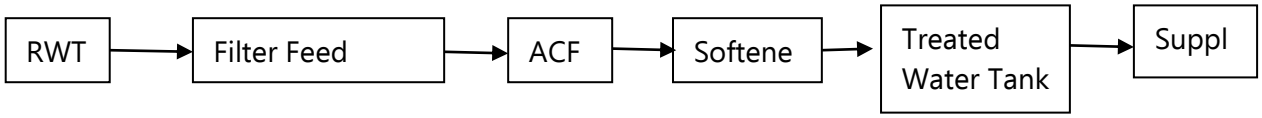
We observed that the belt used in the blowers were loose that decrease the efficiency of the blower. These belts can be replaced by Synchronous belt.

4.5 WTP

Water treatment plant is nothing but the softener plant. There are various WTPs in the premises, however, mainly three are in use which are as follows:

1) WTP B-1
2) WTP G-1
3) WTP B-7

While first two are running continuously, WTP B-7 runs for sometimes. However, all WTP are running at 40-50 % of installed capacity as the valve is throttled to 40-50% before filter feed pump. The average production or yield of the WTP is around 530 m^3/day.



S. No.	Detail	Rated Parameters				Measured Parameters				
		KW	Amp	Efficiency	P. F	Amp	PF	KW	m3/hr	Efficiency
1	WTP B-1 Sump pump	11	21	89.4	0.91	11	0.89	7.1	40	57%
2	WTP B1 Filter feed pump	5.5	11	87	0.88	7.5	0.75	4.1	20	50%
3	WTP G1 Sump pump	5.5	11	87	0.88	7.5	0.75	4.1	26	65%
4	WTP G1 Filter feed pump	4				7.5	0.87	4.7	26	56%

Table 28: Details of WTP Pumps

Overall Performance of pumps is found satisfactory.

4.6 BLOCK PROFILE

MUJ hostel has blocks from B1 to B7 for boys and G1 to G4 for girls. B1 and G1 blocks along with Food court are the biggest consumer of electricity as they also have higher number of rooms in these blocks.

Block	Zone	No. of rooms	Block	Zone	No. of rooms
B1	1	147	G1	1	74
B1	2	212	G1	2	129
B1	3		G1	4	131
B1	4	116	G2	1	163
B2	1	127	G3	1	81
B2	2	205	G3	2	90
B2	3	98	G4	-	173
B3	1	118			
B3	2	90			
B4	1	109			
B4	2	132			
B5	1	75			
B5	2	111			
B6	1	171			
B6	2	66			
B6	3	39			
B7	2	232			
B7	3	132			

Table 29: Block Details

4.6.1 ELECTRICAL PROFILE

Sr. no	Location	Voltage	Current			Unbalance	P. F	KW	Average units per hour
			R	Y	B				
1	G-1	404	137	167	118	19%	0.93	103	110.0
2	G-2	407	70.2	58.2	68.6	11%	0.99	46.85	36.8
3	G-3	404	38.4	25.4	20.1	37%	0.65	14.34	31.6
4	G-4	409	79	86	63	17%	0.95	42.76	34.4
5	B-1	410	273	285	243	9%	0.98	148	162.2
6	B-2	409	161	142	159	8%	0.98	109	76.9
7	B-3	408	76	30	74	50%	0.90	41	48.0
8	B-4	428	67	38	191	94%	0.82	40.13	51.7
9	B-5	425	53	47	75	29%	0.91	70.88	37.2
10	B-6	423	119	81	85	25%	0.97	70.88	62.4
11	B-7	426	115	90	96	15%	0.97	71.86	69.0
12	Food Court	425	94	56	65	31%	0.92	48.08	165.3
13	Facility Block	421	7.59	7.62	7.51	1%	0.65	5.6	39.8

Figure 11:Electrical Profile of Blocks

There are 2 lifts in each block. We measured the load of Lift that is given below:

Sr.no	Parameters	Value
1	Voltage	410
2	Current	8.2
3	P. F	0.87
4	Active power	5.18

It is suggested to restrict one lift from stopping at Floor -1 as it can save some energy. We have said for 1 lift out of 2 rather than both lifts and it can be used during all the times in fact large commercial building used to practice each lift for alternate floors. For Ex: Lift 1 for odd number floor & Lift 2 for even no. floors. During vacation, leaving, entering time it can restore back onto fully functional at all floors.

Note: In fact, we have seen lot of students use stairs for Floor 1 and Floor2 in regular time.

4.6.2 COOLING LOAD PROFILE

Each room is facilitated with 400 CFM and 1 TR Fan Coil Unit (FCU) through which chilled water over air is passes in heat exchanger and provide the required cooling effect for it.

Sr. no	Block	Zone	No. of rooms	Flow (m^3/h)	TR per room	Reqd. TR for 100 sq. ft. room
1	B1	1	147	25.0	0.91	1-1.5
2	B1	2	212	45.0	1.13	1-1.5
3	B1	3				1-1.5
4	B1	4	116	25.5	1.17	1-1.5
5	B2	1	127	7.8	0.33	1-1.5
6	B2	2	205	34.7	0.90	1-1.5
7	B2	3	98	21.8	1.18	1-1.5
8	B3	1	118	26.0	1.18	1-1.5
9	B3	2	90	21.0	1.25	1-1.5

10	B4	1	109	47.8	2.34	1-1.5
11	B4	2	132	29.6	1.20	1-1.5
12	B5	1	75	15.7	1.11	1-1.5
13	B5	2	111	29.1	1.40	1-1.5
14	B6	1	171	29.6	0.92	1-1.5
15	B6	2	66	40.4	3.27	1-1.5
16	B6	3	39	31.6	4.32	1-1.5
17	B7	2	232	23.5	0.54	1-1.5
18	B7	3	132	26.7	1.08	1-1.5
19	G1	1	74	17.9	1.29	1-1.5
20	G1	2	129	28.4	1.18	1-1.5
21	G1	4	131	22.3	0.91	1-1.5
22	G2	1	163	38.7	1.27	1-1.5
23	G3	1	81	51.0	3.36	1-1.5
24	G3	2	90	24.0	1.42	1-1.5
25	G4	-	173	72.0	2.22	1-1.5

Table 30: Cooling Profile of Blocks

Observations

1) For 100 sqft room area, the required cooling load varies from 1 (ground floor) to 1.5 (top floor). Almost all of blocks fulfil the criteria except blocks B2 and B7 where the cooling delivered is less than 1 which may generate less comfort in these blocks.
2) Similarly, few zones of blocks B4, B6, G3 & G4 receive higher cooling than requirement.
3) It is suggested to have same pipe sizes of all risers for all blocks so that flow uniformity could be maintained.
4) Also, few blocks which are near to chillers and have a smaller number of rooms and therefore rooms could be throttled to avoid high flow of chilled water in it and therefore can avoid excessive cooling there.
5) Check for the scaling, corrosion, rusting in pipes and change the faulty ones with PVC pipes that can sustain pressure of Chilled water.
6) B1, G1 blocks have high energy consumption as compared to other blocks due to retail outlets in them.
7) There is a saving potential with the replacement of existing 50 W Havells fan with BLDC fans of 28 W:

Sr.no	Parameters	UOM	Value
1	Wattage of each fan	W	50
2	Wattage of energy efficient fan	W	28
3	Wattage saved	kW	0.022
4	Operating hours	Hours	15
5	Total no of fans to be replaced	No	3000
6	Annual operation days	Days	240
7	Annual Energy saving	KVAh	240000
8	Unit rate	Rs/unit	9.4
9	Annual Monetary Saving (in lakhs)	Rs	22.56

10	Investment (in lakhs)	Rs	90
11	Payback period	Months	47.9

Table 31: Energy Saving Analysis of Fans

4.7 Heat Pumps & HEATER:

Total 33 heat pumps are installed in all the blocks of MUJ hostel to cater the needs of hot water generation but only 18 approx. are in working and rest of them are either not working or blocked due to scaling in coils of heat exchanger.

Block No.	Building No.	No. of Rooms	Heat Pump		Measured Parameters								
						Ambient							
			No	Heating Capacity, kW	Flow (m/s)	DBT, T°C	RH, %	DBT, T°C	RH, %	Power, kW	P. F	Heating Capacity, kW	COP
B1	Zone-1	147	1	40	blocked								
	Zone-2&3	212	2	20, 35	not working								
	Zone-4	116	1	35	blocked								
B2	Zone-1	127	2	20*2	9.83	31.3	36	27	43.2	7.6	0.92	12.3	1.61
	Zone-2	205	1	40	blocked								
	Zone-3	98	1	35	working								
B3	Zone-1	118	1	35	blocked								
	Zone-2	90	1	20	working								
G1	Zone-1	74	1	35	9.16	30.2	37.3	25.4	47.1	10.0	0.87	20.2	2.02
	Zone-2	51	1	35	working								
	Zone-3	78	1	40	blocked								
	Zone-4	131	1	20	9.83	29	40	20	65.3	6.0	0.85	20.8	3.46
G2	Zone-1	163	1	40	blocked								
B4	Zone-1	109	2	35*2	blocked								
	Zone-2	132	1	35	9.85	28.3	44.1	21.9	60.6	13.0	0.85	29.4	2.67
B5	Zone-1	75	1	40	blocked								
	Zone-2	111	1	40	blocked								
B6	Zone-1	171	2	35*2	10.25	26	46	20.2	63.7	10.0	0.91	24.3	2.21
	Zone-2	66	1	35	blocked								
	Zone-3	39	1	35	blocked								
G3	Zone-1	81	1	40	blocked								
	Zone-2	90	1	40	working								
G4	Zone-1	83	1	40	9.48	27.4	43.5	20.6	64.3	14.0	0.88	25.4	2.17
	Zone-2	90	1	40	working								
FC	N Zone		1	35	not working								
	S Zone		1	35	9.70	31.5	36.6	28.8	42.2	10.0	0.85	10.9	1.40
B7	Zone-2	232	2	30	7.50	27.5	42.8	19.4	65	8.3	0.68	27.2	3.48
	Zone-3	102	1	30	10.60	27.5	42.8	19.5	72	11.6	0.77	27.6	3.53

Table 32: Analysis of Heat Pumps

Almost 50% Sample is selected to measure the performance of the Heat Pumps. Therefore, savings have been calculated from faulty machines from sample and then double the energy saving potential from it.

1) **Replacement of Inefficient heat pumps (Either by new heat pump or through staform hot water system)**

Option -1: Inefficient heat pumps can be replaced by new heat pumps for which the analysis is given below:

Sr. No.	Particulars	UOM	Values
1	Existing COP		Less than 2
2	Proposed COP		3
3	Energy Saving	kW	19.8
4	Annual operating hrs	hrs	2000
5	Annual Energy Saving	kWh	39527
6	Unit Rate	Rs/kWh	9.4
7	Annual Monetary Saving	Rs	371552
8	Investment	Rs	600000
9	Payback	months	19

Table 33: Energy saving analysis Heat pumps

Option 2: Inefficient heat pumps can be replaced by Stafor heat carrier. Below given are the comparison between Stafor heat carrier and heat pumps and saving analysis of the same:

Figure 12: Images of Stafor Carrier

Sr. No.	Stafor Heat Carrier	Heat Pump
1	Stafor Boiler gives COP up to 204% on any temperature. It doesn't affect by ambient temperature. It can work easily in -40 ℃ and has ability to 24x7 days continues operation. Can give maximum temperature continues in	Heat Pump claims COP up to 400% @ ambient temperature 25-30 ℃. At ambient temp. 10 ℃ or less its COP will be max. up to 200% and can't reach the targeted temperature it goes Max. 45-48 ℃. It doesn't comfort in 24x7 days working it

	minimum ambient temperature without any shut down.	blinks over heating errors and during less temperature its evaporator coils gets freeze and system shuts down immediate.
2	Temperature can be raised up to 90-95 C.	Temperature can be raised up to 55-60℃.
3	There is no regular maintenance require for Ion boiler that's why the recurring cost is nominal.	Regular maintenance requires and gets higher when operation time is more. Parts are not easily available.
4	System doesn't shut down due to any types of water because it always comes with PHE and that can be service easily by any plumber.	Most of the heat pump comes with inbuilt coil System that get affected due to hard water and only technical person can handle the problem and takes much time to resolve the problem. PHE base can be service easily.
5	The heat carrier liquid life is although 12 years but after about 8 years it should be refill again on minimum cost for better performance. Whole system has a lifespan about 20-25 years.	Heat Pump life span is about 8-10 years in Ideal position and due to hard water, it gets less.
6	Stafor Boiler load can be decided manually according to requirement of temperature. It saves the Energy consumption.	Heat pump works on a fix load according to factory setting we cannot change manually.
7	For Cold Region the efficiency of Ion Boiler will be same for the temperature up to -40℃.	NA
8	Automatic shutdown of the boiler at a "loss" of any incoming electrical phases and voltage up (250V) and down (180V). Fully automated switch on of the system when power is restored. This keeps the boiler in economy mode.	NA
9	Eco Friendly, Noise Pollution- No Air Pollution-No	Noise Pollution- Yes Air Pollution- No
10	Space Require-Less	Space Require -Big

Table 34: Comparison between Stafor heat carrier and heat pumps

Sr.no	Particulars	UOM	Values
1	Existing COP of Heat Pump		< 2
2	Proposed COP of Stafor Boiler		2
3	Electric Load for back up as Heat Pump gets faulty or locked due to low ambient temp	kWh	540.8
4	Electric load for Heat Pump for less COP	kW	172.7
5	Electric Load for Stafor Heat Carrier system	kWh	469.3
6	Annual operating days	days	200
7	Annual Energy Saving	kVAh	49332.8
8	Unit Rate	Rs/KVAh	9.4
9	Annual Maintenance Cost of Heat pump	Rs.	45000

10	Annual Monetary Saving (in Lakhs)	Rs	5.08
11	Investment (in Lakhs)	Rs	7.8
12	Payback	months	18.5

Table 35: Energy saving analysis Heat pumps

Conclusion: By comparing both the options we suggest to implement Option-2 as operational cost is reduced as heat pumps get choked due to low (less than 10 °C) ambient temperature and the saving potential is higher in stafor heat pump.

2) Cleaning and Maintenance of Heat Pumps to restore the COP

Sr. No.	Particulars	UOM	Values
1	Existing COP		Less than 2
2	Proposed COP		3
3	Energy Saving	kW	19.8
4	Annual operating hrs	hrs	2000
5	Annual Energy Saving	kWh	39527
6	Unit Rate	Rs/kWh	9.4
7	Annual Monetary Saving	Rs	371552
8	Investment	Rs	600000
9	Payback	months	19

Table 36: Energy saving analysis Heat pumps

Heaters:

We Measured the electrical parameter of the heaters on sample basis. Our findings are given below:

Sr.no	Location	Power	P.F	Remark
1	G1 Zone-3	5.69	0.99	Satisfactory
2	G1 Zone-2	5.92	0.99	Satisfactory
3	G1 Zone-1	5.69	0.99	Satisfactory
4	G1 Zone-4	5.70	0.99	Satisfactory
5	G3 Zone-1	5.80	0.99	Satisfactory
6	B2 zone-1	6.15	0.99	Satisfactory

Table 37: Analysis of Heater

The performance of the heaters are found to be satisfactory. Our Suggestion will be to not run the heaters for a long period of time.

4.8 DG PERFORMANCE ASSESSMENT:

There are 6 DG of 500 KVA each in New door for Backup power generation. We measured the fuel level and energy generation of DG 1 & 6 to determine their performance. Data are provided below:

Figure 13: DG Performance Test

Sr.no	DG No	Start Time	Stop Time	Duration	KWh Consumption	Diesel Consumed	KW/ltr
1	1	15:28	15:48	20	72.129	25.2	2.862
2	6	16	16:20	20	75.61	25.2	3.0

Table 38: DG Performance assessment

Observation: During the measurement as no proper method was available for accurate measurement of Fuel oil and less duration of the study, 20-25% addition can be assumed **in the study which makes the performance of the DG's satisfactory.**

As the operation time of the DG's is less which makes the replacement of DG's **highly infeasible.**

4.9 LIGHTING STUDY:

We measured the Lux level with our instrument in different areas. Below given are our findings:

Sr.no	Location	Standard Lux	Measured Lux	Remark
1	Corridor	50-100	61	Satisfactory
2	Staircase	50-100	57	Satisfactory
3	Rooms	150-200	178	Satisfactory
4	Bathroom	150-200	198	Satisfactory
5	Peripheral Roads	50-100	51	Satisfactory
6	Public Places	100-150	113	Satisfactory
7	Offices	150-200	169	Satisfactory

Table 39: Lux Level in different areas

As per IES recommended Lighting level with combination of lighting.

We observed that the lights used for the peripheral roads are of 90-Watt and 60-Watt LED that use grid power. We recommend using solar power street light with battery for the peripheral roads and replacing 90-Watt bulbs with 60-Watt bulbs. Below given is our analysis

Sr.no	Parameters	UOM	60-Watt
1	Wattage of streetlight	W	60
2	Wattage saved by installing solar and converting 90-watt Bulb to 60 watts	kW	0.09
3	Operating hours	Hours	12
4	Total no of lights to be replaced	No	63
5	Annual operation days	Days	360
6	Annual Energy saving	KVAh	24741.8
7	Unit rate	Rs/unit	9.4
8	Annual Monetary Saving	Rs	2.33
9	Investment	Rs	9.45
10	Payback period	Months	48.8

4.10 Major retail Outlets:

Electrical safety Inspection:

• **Location- Login** • **Observation: DB Cover is not grounded.** • **Risk/violation: NEC 2011** • **Action Required: DB Cover Grounding should be done.**	
• **Location-Login** • **Observation: Fire extinguisher is past its Refilling date.** • **Risk/violation: NEC 2011** • **Action Required: Refilling should be done within the given time period.**	

• **Location- Login** • **Observation: Temporary connection is made.** • **Risk/violation: NEC 2011** • **Action Required: Remove temporary connection and fix a permanent fixture.**	
• **Location- 360** • **Observation: Lugs are not used for connections.** • **Cable dressing is improper.** • **Risk/violation: NEC 2011** • **Action Required: Lugs should be used for connections.**	

• **Location- 360** • **Observation: Cable trays are not used for cable laying.** • **Risk/violation: NEC 2011** • **Action Required:** • **Cable trays should be used.**	
• **Location-360** • **Observation: Exposed wire is observed.** • **Risk/violation: NEC 2011** • **Action Required: Wire should be properly insulated.**	

• **Location- 360** • **Observation: Earth strip is not present for LT Panel.** • **Risk/violation: NEC 2011** • **Action Required:** • **Earth strip should be provided.**	
• **Location- Tandoor** • **Observation: Exposed wire is observed.** • **Risk/violation: NBC 2016** • **Action Required: Wire should be properly insulated.**	

• **Location- Tandoor** • **Observation: Jointing of wires is done with temporary connection** • **Risk/violation: Best practise** • **Action Required: Single unjointed wire should be laid from source to load.**	
• **Location- Tandoor** • **Observation: Metal sheets are used as Covers.** • **Risk/violation: NEC 2011** • **Action Required: Replace the metal sheets with plastic coated covers instead.**	

• **Location- Tandoor** • **Observation: Rodent found dead inside DB.** • **Risk/violation: NBC 2016** • **Action Required: The area where small gap is found should all be covered in DB.**	
• **Location- Coffee shop** • **Observation: Earth mat is not used.** • **Risk/violation: NEC 2011** • **Action Required: Earth mat according to IS Code should be used at all panel area.**	

Electrical Load Distribution:

We measured the Electrical Load at each of the retail outlet with our instrument. Below given is our findings:

Sr. no	Location	Voltage	Current			Power factor	kW	THD-V	THD-I	Un balanced	Average
			R	Y	B						
1	Login	413	7.6	3.8	10.1	0.89	2.63	1.9	2.9	47%	7.17
2	360-Meter-1	409	2.2	3.8	5	0.85	1.27	1.4	3.3	40%	3.67
3	360-Meter-2	410	2	2.5	7	0.88	1.38	0.9	2.8	83%	3.83
4	Tandoor	415	0.6	4.4	6.4	0.87	1.37	1.4	3.5	84%	3.80
5	Food Court	411	3.1	2.2	2.1	0.84	0.85	1.7	3.4	26%	2.47
6	Food Court Bakery	411	5.7	18	3.3	0.84	3.11	1.7	3.4	100%	9.00

Table 40: Power quality of Retail Outlet

OBSERVATIONS:

1. Major Observation is that Current imbalance is observed in all the outlets. This is a cause of concern as it may pose a hazard in the near future.
2. Both THD-V and THD-I are within IEEE Standards.

4.11 RENEWABLE ENERGY:

At New Door there are 2 solar power plant installed. One of 50 KWp and the other of 800KWp. 50 KWp plant is used for food court while 800KWp plant is used for captive Generation. We connected our analyser at Solar panel of 11 KV to capture its parameters. Below given is our findings:

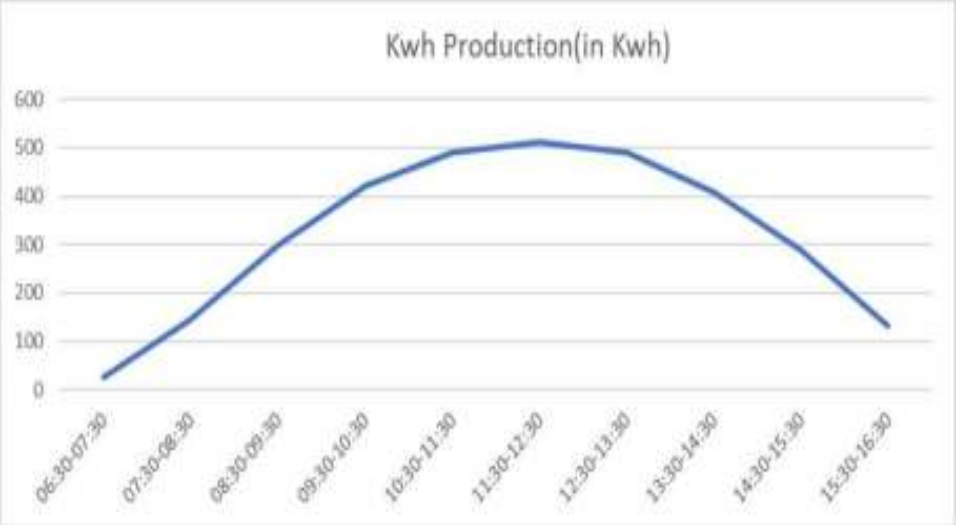


Figure 14:KWh Production of solar per hour

S.No	Time	KWh Production
1	06:30-07:30	26.3
2	07:30-08:30	146.1
3	08:30-09:30	299.9
4	09:30-10:30	421.0
5	10:30-11:30	491.5
6	11:30-12:30	511.3
7	12:30-13:30	489.7
8	13:30-14:30	407.4
9	14:30-15:30	288.4
10	15:30-16:30	131.2

Table 41: Solar Production

The total unit generation of the plant is about 3200, which is about 4 unit/KWp. The average capacity utilisation factors the plant is found to be 18% which is satisfactory.

ANNEXURE 1: WATER SURVEY FORM

Building Information

Building Name: Manipal University Hostel, Jaipur
Age of building: > 10 yrs
Type of building: Hostel /Residential
Numbers of permanent occupants: 4500 persons
Where does your water come from? Outside
Number of buildings at facility: 15 Size of buildings (area):
Number of employees per shift: 200 Number of shifts per day: _____
Water pressure at your facility: 2 kg/cm^2

Washrooms
Tank type:
Number: 3000 @ 6/4 litres per flush

Urinals
Sensor flush:
Number _____@___2/3___ litres per flush

Total water consumption per workday from toilet flushes: _____
* Assuming each employee/occupant uses the bathroom 4x per workday

Newer urinals and toilets have the gallons/litres per flush printed on the unit with the name of the manufacturer. Older toilets and urinals do not. If there is no indication on flush volume, note the manufacturer and the age of the toilet or urinal. With this information the manufacturer can provide flush volume information. The volume of the flush can be adjusted on these units. The flush or meter manufacturer can provide the flush volume data or the data may be found in the building maintenance manuals.

Basins/faucets
# of faucets ___3000_____ Flow rate _____lpm sensor control
# of faucets _____1000____ Flow rate _____ lpm sensor control

Showers
Number of showers __3000_____ Showerhead flow rate _____ gpm/ls

Kitchens/Cafeterias/Lunch rooms
Number of staff: 70
Number of kitchen sinks/ faucets: 17 Faucet flow rates: _____ lpm
Number of meals served/day: 9000
Do spray heads have automatic shut off? NA
Do refrigerators provide drinking water? NA
Do kitchens use: garbage disposals composting neither Yes but not working therefore sending to vendor for disposals
Is there a dishwasher? _1_____ Average number of loads per week: 35
Are only full loads washed? yes
Are dishes routinely pre-rinsed prior to wash? yes
Is frozen food routinely thawed under running water? yes
Are kitchen floors hosed clean? ____yes____ How often? ___4 times per day_____
Are hoses equipped with high-pressure, water efficient nozzles? ____NA____

Number of Drinking fountains: air cooled __1____
Number of Vending machines/ coffee makes/ water coolers/ etc. connected to the domestic water system: 2
Number of Ice machines: deep freezer air cooled
If automatic regeneration, is it initiated by: time meter sensor

Cleaning/Janitorial

Are janitorial staff aware of office water conservation efforts? yes
Are there areas that janitors mop? Yes Where: rooms and toilets
Are hoses used? No
Are dry-clean (rather than wet-clean) practices and procedures in place? (i.e. sweep instead of hosing, scrape before spraying, etc.) Yes

Landscaping/Irrigation

Does your landscape use mulch? STP treated water
Does your facility have an automatic irrigation system? _Yes, up to some extent but more manual
What does the system irrigate? Plants/greenery
How often? 2-3 At what time of day? day
Is there a rain gauge and/or rain sensor incorporated in your system? No
Is your irrigation water metered? No
Is there a municipal sewer charge rebate on irrigation water? No
Are hoses equipped with fine-spray/high-pressure/water-efficient nozzles? No
Does your facility have any pools or fountains? No

Heating, Ventilating and Air Conditioning (HVAC) Consumption

What type of HVAC system do you have? Air Cooled Chillers
Are drink machines in vending areas? air-cooled
Are cooling towers in use at your facility? No
Are faucets, pipes and plumbing checked regularly for leaks? Yes
Are maintenance staff to respond to and repair leaks? Yes
(Often reducing water pressure by merely 10 or 15 percent can reduce water consumption significantly without interfering in daily consumption activities. Water pressure that is too high can result in leaks.)
Does staff have good general water conservation awareness habits? Yes
Have you ever had a water-balance or leak-check? Yes
(Entails shutting off all known water usage. If the meter records any water usage during this period, you have a leak or undocumented consumption.)
Is there an on-site water treatment facility? Yes
If so, give a brief description of the facility, flow rates, chemical additions, and average cost (per unit volume).
Is there an on-site wastewater treatment facility? Yes, if so, give a brief description of the facility, flow rates, chemical additions, and average cost (per unit volume).
Are toilets equipped with toilet dams or low-flow flapper valves? Yes
Do flush valve (tankless) toilets have water-saving diaphragms? ❑ Yes ❑ No
Are toilets equipped with automatic water-flushing systems? No
Are faucets equipped with aerators? Yes
Are faucets equipped with automatic or metered shutoff mechanisms? No

ANNEXURE 2: ENERGY CONSERVATION TIPS

Electricity:

- Schedule Your Operations to Maintain A High Load Factor
- Minimize Maximum Demand by Tripping Loads Through A Demand Controller
- Use Standby Electric Generation Equipment for On-Peak High Load Periods.
- Correct Power Factor To At Least 0.99 Under Rated Load Conditions.
- Set Transformer Taps to Optimum Settings.
- Shut Off Unnecessary Computers, Printers, And Copiers at Night.

Motors:

- Properly size to the load for optimum efficiency.
- **High efficiency motors offer of 4-5% higher efficiency than standard motors**
- Check alignment.
- Provide proper ventilation
- (For every 10°C increase in motor operating temperature over recommended peak, the motor life is estimated to be halved)
- Check for under-voltage and over-voltage conditions.
- Balance the three-phase power supply.
- An Imbalanced voltage can reduce 3 - 5% in motor input power
- Demand efficiency restoration after motor rewinding.

Pumps:

- Operate pumping near best efficiency point.
- Modify pumping to minimize throttling.
- Adapt to wide load variation with variable speed drives or sequenced control of smaller units.
- Stop running both pumps -- add an auto-start for an on-line spare or add a booster pump in the problem area.
- Use booster pumps for small loads requiring higher pressures.
- Repair seals and packing to minimize water waste.

HVAC (Heating / Ventilation / Air Conditioning):

- Tune up the Air Conditioning control system.
- Use appropriate AC thermostat setback.
- In winter during unoccupied periods, allow temperatures to fall as low as possible without freezing water lines or damaging stored materials.
- In summer during unoccupied periods, allow temperatures to rise as high as possible without damaging stored materials.
- Improve control and utilization of outside air.
- Use air-to-air heat exchangers to reduce energy requirements for heating and cooling of outside air.

- Reduce AC system operating hours (e.g. -- night, weekend).
- Optimize ventilation.
- Ventilate only when necessary. To allow some areas to be shut down when unoccupied, install dedicated AC systems on continuous loads (e.g. -- computer rooms).
- Use evaporative cooling in dry climates.
- Clean AC unit coils periodically and comb mashed fins.
- Upgrade filter banks to reduce pressure drop and thus lower fan power requirements.
- Check AC filters on a schedule (at least monthly) and clean/change if appropriate.
- Check pneumatic controls air compressors for proper operation, cycling, and maintenance.
- Isolate air-conditioned loading dock areas and cool storage areas using high-speed doors or clear PVC strip curtains.
- Install ceiling fans to minimize thermal stratification in high-bay areas.
- Relocate air diffusers to optimum heights in areas with high ceilings.
- Consider reducing ceiling heights.
- Use spot cooling and heating (e.g. -- use ceiling fans for personnel rather than cooling the entire area).
- Purchase only high-efficiency models for AC units.
- Put AC window units on timer control.
- Don't oversize cooling units. (Oversized units will "short cycle" which results in poor humidity control.)
- Consider dedicated make-up air for exhaust hoods. (Why exhaust the air conditioning or heat if you don't need to?)
- Minimize AC fan speeds.
- Eliminate simultaneous heating and cooling during seasonal transition periods.
- Establish an AC efficiency-maintenance program. Start with an energy audit and follow-up, then make an HVAC efficiency-maintenance program a part of your continuous energy management program.

Lighting:

- Replace existing T8, CFL by LED.
- Reduce excessive illumination levels to standard levels using switching, de-lamping, etc. (Know the electrical effects before doing de-lamping.)
- Aggressively control lighting with clock timers, delay timers, photocells, and occupancy sensors.
- Install efficient alternatives to incandescent lighting, mercury vapour lighting, etc. Efficiency (lumen/watt) of various technologies range from best to worst approximately as follows: low pressure sodium, high pressure sodium, metal halide, fluorescent, mercury vapour, incandescent.

- Select ballasts and lamps carefully with high power factor and long-term efficiency in mind.
- Upgrade obsolete fluorescent systems to Compact fluorescents and electronic ballasts
- Consider lowering the fixtures to enable using less of them.
- Consider day lighting, skylights, etc.
- Consider painting the walls a lighter color and using less lighting fixtures or lower wattages.
- Use task lighting and reduce background illumination.
- Re-evaluate exterior lighting strategy, type, and control. Control it aggressively.

DG sets:

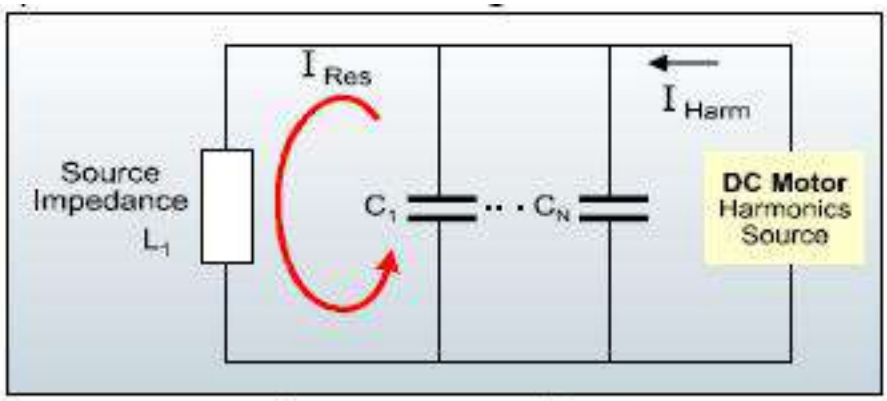
- Optimize loading
- Use jacket and head cooling water for process needs
- Clean air filters regularly
- Insulate exhaust pipes to reduce DG set room temperatures
- Use cheaper heavy fuel oil for capacities more than 1MW

Buildings:

- Seal exterior cracks/openings/gaps with caulk, gasketting, weather stripping, etc.
- Consider new thermal doors, thermal windows, roofing insulation, etc.
- Install windbreaks near exterior doors.
- Replace single-pane glass with insulating glass.
- Consider covering some window and skylight areas with insulated wall panels inside the building.
- If visibility is not required but light is required, consider replacing exterior windows with insulated glass block.
- Consider tinted glass, reflective glass, coatings, awnings, overhangs, draperies, blinds, and shades for sunlit exterior windows.
- Use landscaping to advantage.
- Add vestibules or revolving doors to primary exterior personnel doors.
- Consider automatic doors, air curtains, strip doors, etc. at high-traffic passages between conditioned and non-conditioned spaces. Use self-closing doors if possible.
- Use intermediate doors in stairways and vertical passages to minimize building stack effect.
- Bring cleaning personnel in during the working day or as soon after as possible to minimize lighting and HVAC costs.

ANNEXURE 3: GENERAL INFORMATION ABOUT HARMONICS AND ITS STANDARDS HARMONIC RESONACE

Capacitors do not generate harmonics but application of the same in any network with adequate protection magnifies the existing harmonic content. Then there can be a problem of parallel resonance which takes place between Reactive impedance of capacitor bank and impedance of other network devices like Transformers, Cables etc. The Problem of resonance as explained below in the diagram.

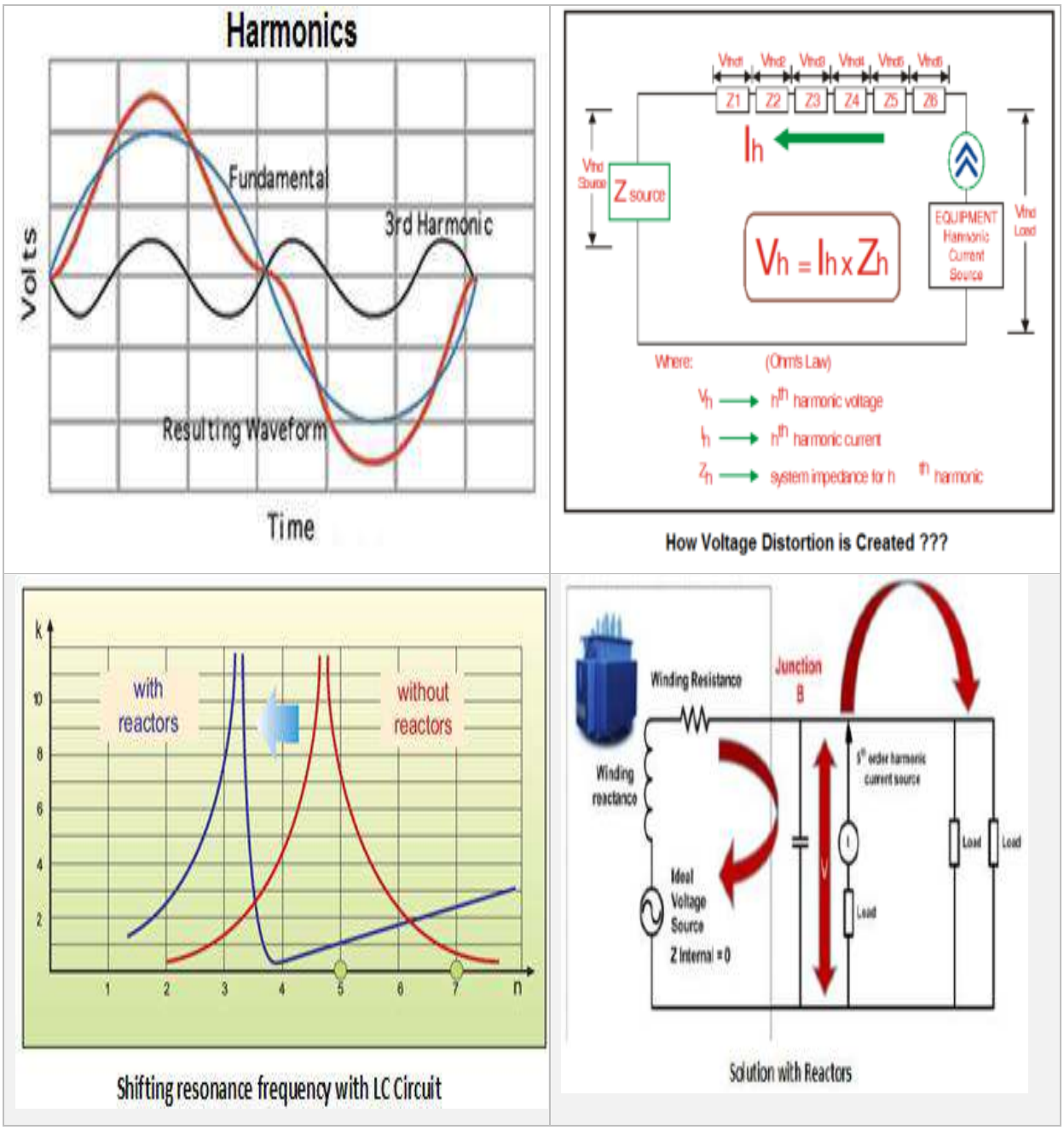


Resonance conditions

The harmonic and resonance can create negative influence on capacitor bank and other network devices. This can cause pre-mature failure / de-rating / busting of capacitor bank and other failure in the network devices like electronic cards / parts, overheating of switchgear /cables/transformers etc.

Some other problems because of high harmonic distortions can be as follows:

1. Malfunctioning and failure in electronic equipment
2. Overheating and failure in transformers and cables
3. Overload and failure in capacitor banks, contactors & switchgears in APFC System
4. Low efficiency of transformers and cables
5. Tripping of protections without apparent reason
6. Overload and failure in motors
7. Interferences in communication network



Maximum Voltage Distortion for SEB/Utility as per IEEE Standard 519:

Bus Voltage at PCC	Individual Voltage Distortion (%)	Total Voltage Distortion THD (V) (%)
69 kV and below	**3.0**	**5.0**
69.001 kV through 161 kV	1.5	2.5
161 kV and above	1.0	1.5
Note: High voltage systems can have up to 2.0% THD where the cause is an HVDC terminal that will attenuate by the time it is tapped for a user.		

Table 42: IEEE THD V Standard

To assess the presence of current harmonic disturbing the power quality of electrical network, we have to calculate the short circuit ratio I_{sc}/I_L, through following formula where I_{SC} is the max short circuit current at the point of coupling "PCC". I_L is the max fundamental frequency load current at PCC. TDD is the Total Demand Distortion (=THD normalized by I_L).

I_{SC} at the secondary of transformer = $\frac{\text{Rated Capacity of Transformer}}{\text{Impedance of transformer}}$

Limits of Voltage & Current Harmonics as Per IEEE-519-2014:

For PCC Voltages 69kV & below						
Maximum Harmonic Current Distortion in % of I_L						
Individual Harmonic Order (Odd Harmonics)						
I_{sc}/I_{load}	**<11**	**11≤h<17**	**17≤h<23**	**23≤h<35**	**35≤h**	**TDD**
<20*	4	2	1.5	0.6	0.3	5
20 < 50	7	3.5	2.5	1	0.5	8
50 < 100	10	4.5	4	1.5	0.7	12
100 < 1000	12	5.5	5	2	1	15
> 1000	15	7	6	2.5	1.4	20
Even harmonics are limited to 25% of the odd harmonics limits above.						
Current distortions that result in a direct current offset, e.g., half wave converters are not allowed.						
*** All power generation equipment is limited to these values of current distortion, regardless of actual Isc/I_L.**						
Where, **I_{sc} = Maximum short circuit current at Pcc. And I_L = Maximum Demand Load Current (fundamental frequency component) at PCC; TDD = Total Demand Distortion** **The table is for 6 pulse rectifiers. For 12-pulse, 18-pulse, etc. increase characteristic harmonics by: the value of the square root of q/6, where q = 12, 18, etc. Thus for 12-pulse, increase by 1.414.**						

Table 43: IEEE THD I Standard

ANNEXURE 4: THERMOGRAPHY

We have scanned the Electrical Installations of your facility with an Infrared Camera of Fluke Make and it is one of the best imager available in the world for electrical & industrial applications.

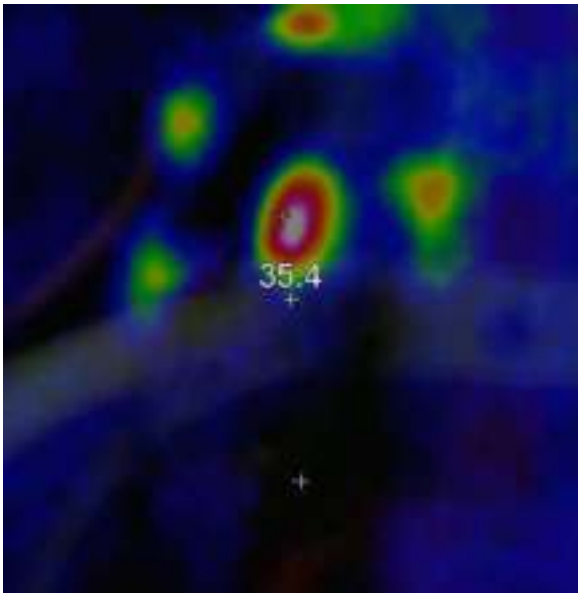
During the scanning process, in all 26 anomalies were identified and ambient temperature is taken 26^{O}C. As per the severity priority rating considered in the report, categorization of the anomalies and their repair priorities are as under-

Anomaly Summary:

Sr. No	Location	Measured Temperature (^{O}C)	Remark
1	STP MLD Panel-1 main incomer	35.4	No Need to repair
2	STP MLD Panel-1 350 KLD	76.4	Repair Immediately
3	STP MLD Panel-1 30HP Blower MCCB STP	29.6	No Need to repair
4	STP 360 KLD incomer	28.2	No Need to repair
5	LT Room MV Panel-3 Busbar	27.4	No Need to repair
6	LT Room ACCP Panel-1 incomer	30.4	No Need to repair
7	LT Room ACCP Panel-2 incomer	27.9	No Need to repair
8	LT Room main MV Panel EB-2 incomer	27.8	No Need to repair
9	LT Room main MV Panel EB-1 incomer	26	No Need to repair
10	LT Room main ACCP Panel-3 incomer	27	No Need to repair
11	Chiller Room New Panel-1 incomer	26	No Need to repair
12	Chiller Room New Panel-2 incomer	24.7	No Need to repair
13	Chiller Room MCC Panel-2 incomer	25.2	No Need to repair
14	Chiller Room MCC Panel-1 incomer	32.8	No Need to repair
15	Chiller Room MCC Panel-3 incomer	32.4	No Need to repair
16	Transformer-2	31	No Need to repair
17	G Block Ground Floor Elect. Room Power DB	30.5	No Need to repair
18	G Block Ground Floor Elect. Room incomer	32.5	No Need to repair
19	G Block Ground Floor Elect. Room MCCB	30.1	No Need to repair
20	MDB Panel block G-4	29.2	No Need to repair
21	G-2 Ground Floor Elect. Room outside Power DB	28.6	No Need to repair
22	G-1 Common Area 1st floor 360 shop	28.8	No Need to repair
23	G-1 Common Area 1st floor 360 shop Power DB	30.7	No Need to repair
24	G-1 360 Elect. Panel incomer	31.9	No Need to repair
25	G-1 Common Area Ground floor tandoor Power DB	32.8	No Need to repair
26	G-1 Common Area Ground floor tandoor Power DB	55.1	Repair as soon as possible

Table 44: Thermography Table

1. STP MLD Panel-1 1main incomer



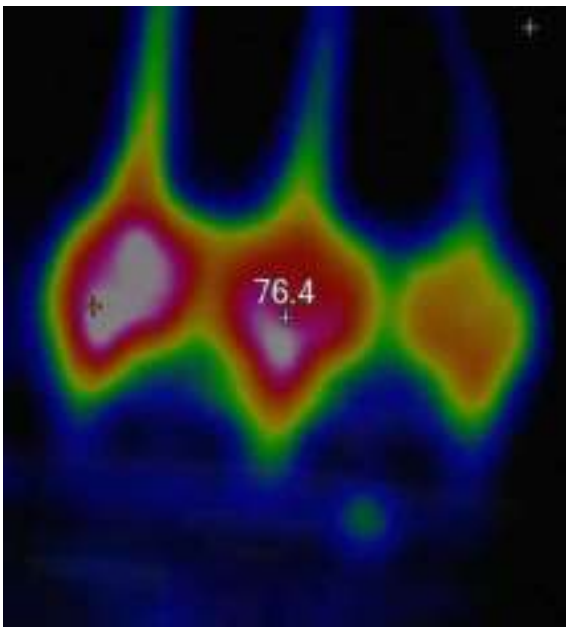
Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	35.4°C

2. STP MLD Panel-1 350 KLD



Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	76.4°C

3.STP MLD Panel-1 30HP Blower MCCB STP

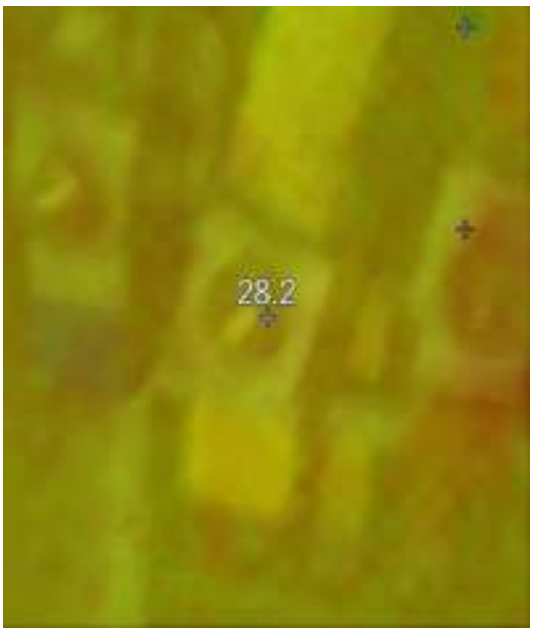
Infrared Image

Visible Light Image

Image Info

Centerpoint	29.6°C
Emissivity	0.95

4. STP 360 KLD incomer



Infrared Image

Visible Light Image

Image Info

Centerpoint	28.2°C
Emissivity	0.95

5.LT Room MV Panel-3 Busbar

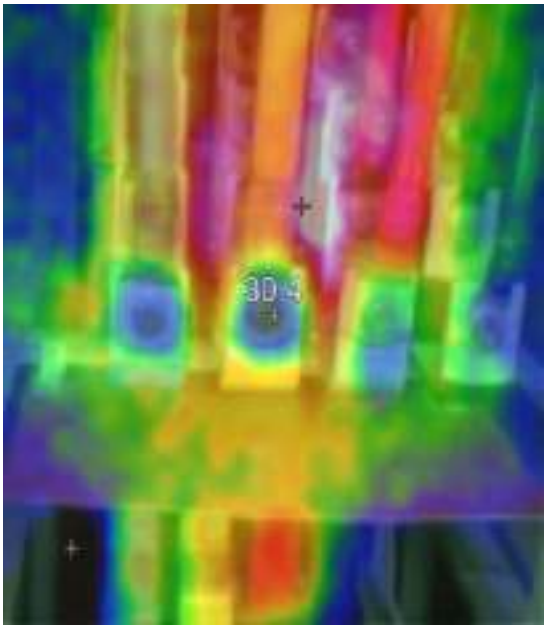
Infrared Image

Visible Light Image

Image Info

Centerpoint	27.4°C
Emissivity	0.95

6. LT Room ACCP Panel-1 incomer



Infrared Image

Visible Light Image

Image Info

Centerpoint	30.4°C
Emissivity	0.95

7. LT Room ACCP Panel-2 incomer

Infrared Image

Visible Light Image

Image Info

Centerpoint	27.9°C
Emissivity	0.95

8. LT Room main MV Panel EB-2 incomer

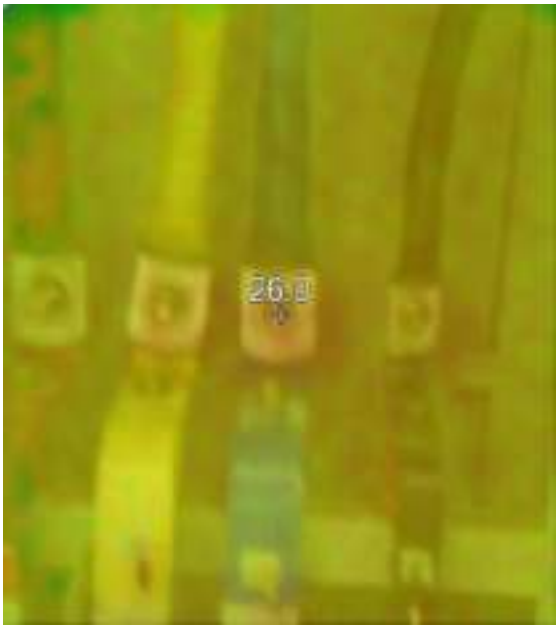
Infrared Image

Visible Light Image

Image Info

Centerpoint	27.8°C
Emissivity	0.95

9. LT Room main MV Panel EB-1 incomer



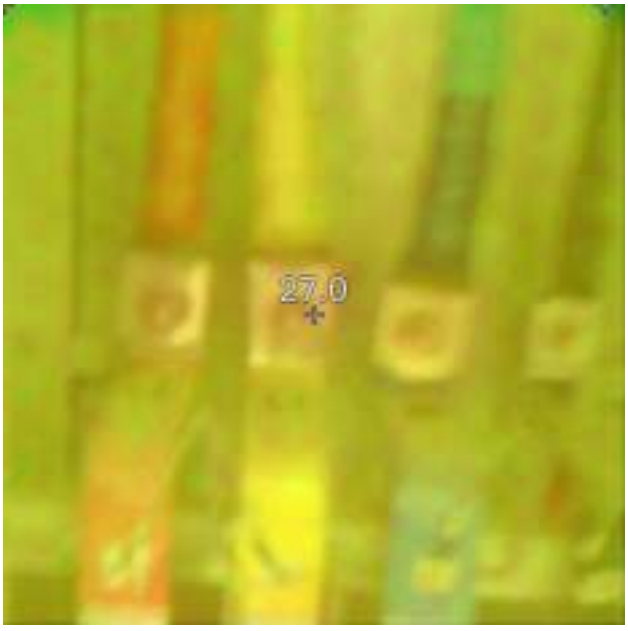
Infrared Image

Visible Light Image

Image Info

Centerpoint	26.0°C
Emissivity	0.95

10. LT Room main ACCP Panel-3 incomer



Infrared Image

Visible Light Image

Image Info

Centerpoint	27.0°C
Emissivity	0.95

11. Chiller Room New Panel-1 incomer

Infrared Image

Visible Light Image

Image Info

Centerpoint	26.0°C
Emissivity	0.95

12. Chiller Room New Panel-2 incomer

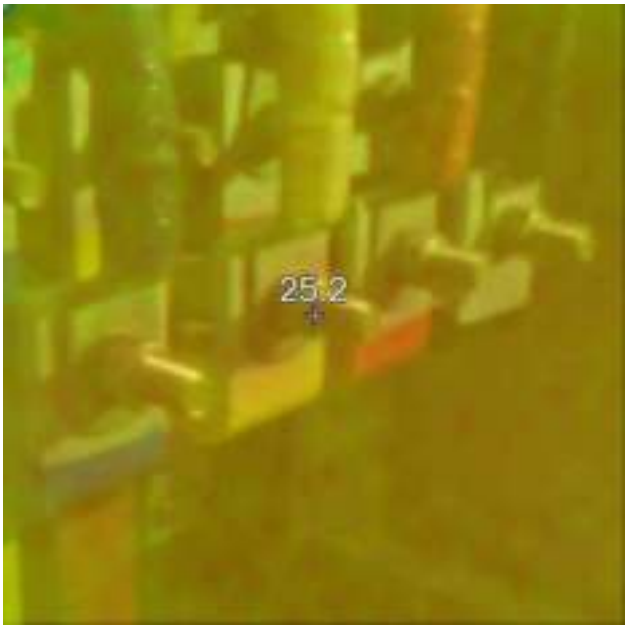
Infrared Image

Visible Light Image

Image Info

Centerpoint	24.7°C
Emissivity	0.95

13. Chiller Room MCC Panel-2 incomer



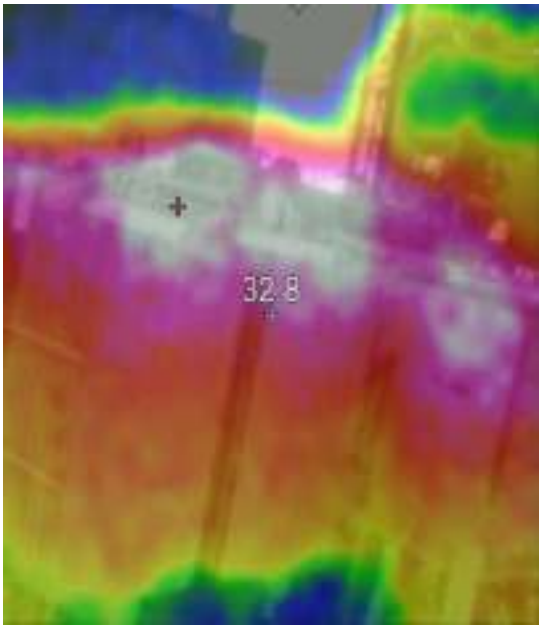
Infrared Image

Visible Light Image

Image Info

Centerpoint	25.2°C
Emissivity	0.95

14. Chiller Room MCC Panel-1 incomer



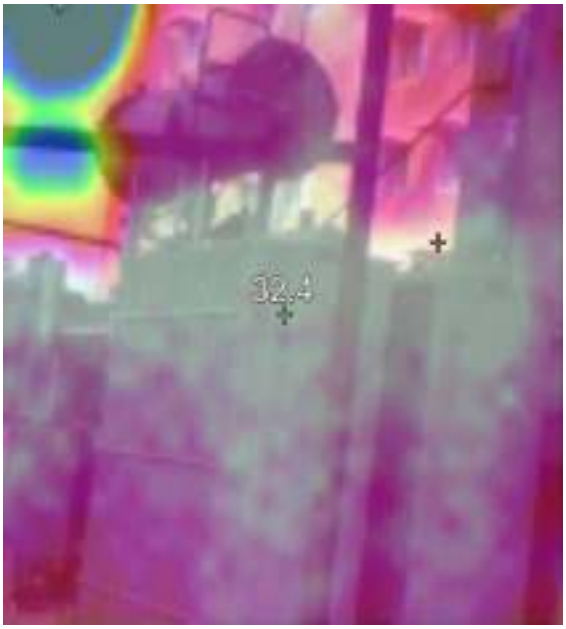
Infrared Image

Visible Light Image

Image Info

Centerpoint	32.8°C
Emissivity	0.95

15. Chiller Room MCC Panel-3 incomer



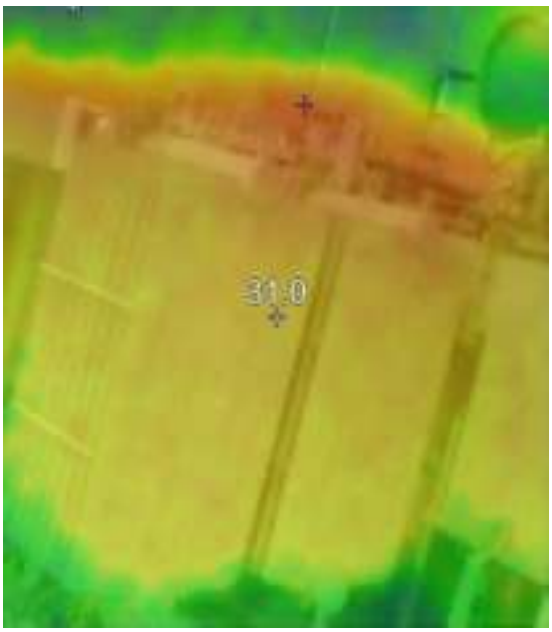
Infrared Image

Visible Light Image

Image Info

Centerpoint	32.4°C
Emissivity	0.95

16. Transformer-2



Infrared Image

Visible Light Image

Image Info

Centerpoint	31.0°C
Emissivity	0.95

17. Transformer-3

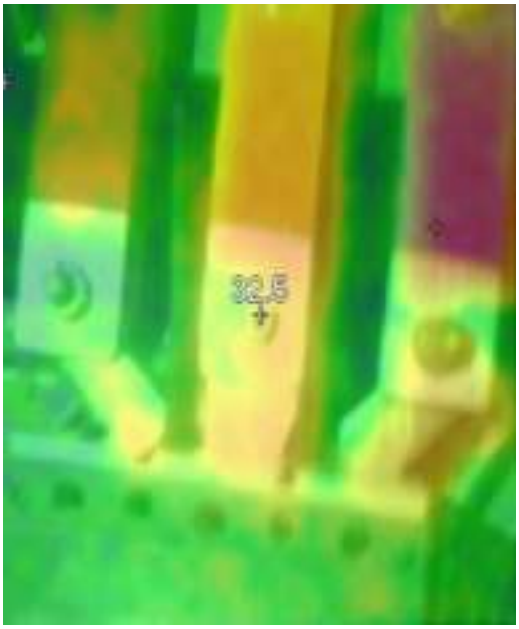
Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	30.5°C

18. Transformer-1



Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	32.5°C

19. G Block Ground Floor Elect. Room Power DB

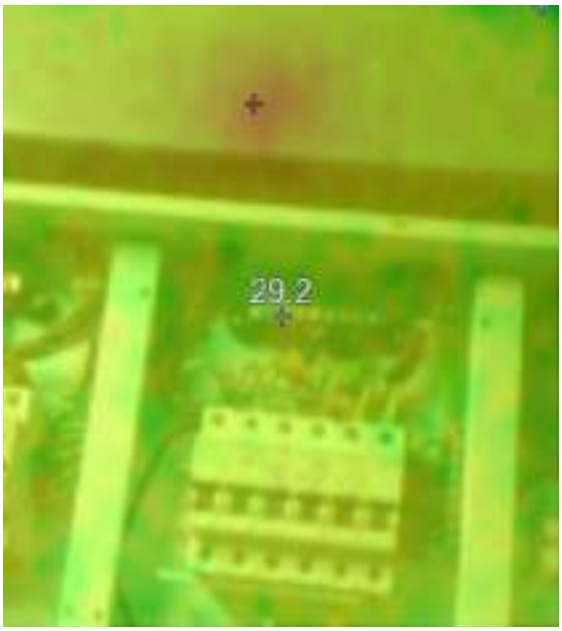
Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	30.1°C

20. MDB Panel block G-4



Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	29.2°C

21. G-2 Ground Floor Elect. Room outside incomer

Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	28.6°C

22. G-1 Common Area 1st floor 360 shop

Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	28.8°C

23. G-1 Common Area 1st floor 360 shop Power DB

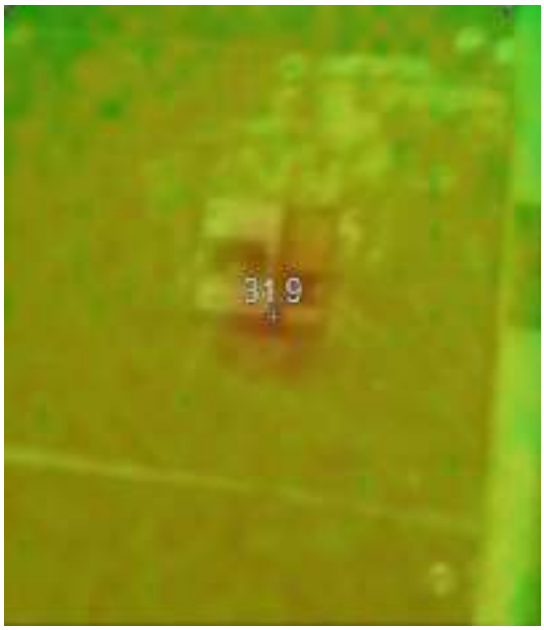
Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	30.7°C

24. G-1 360 Elect. Panel incomer



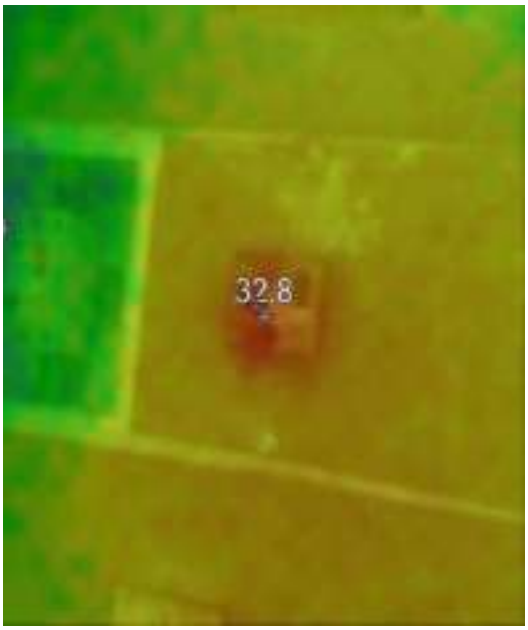
Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	31.9°C

25. G-1 Common Area Ground floor tandoor Power DB



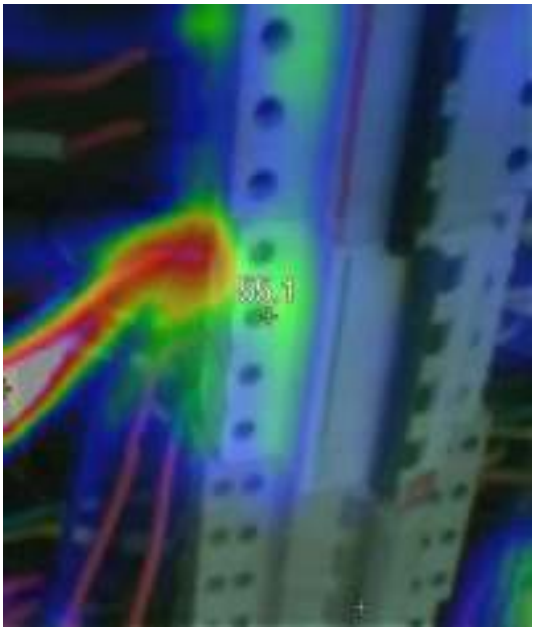
Infrared Image

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	32.8°C

26. G-1 Common Area Ground floor tandoor Power DB



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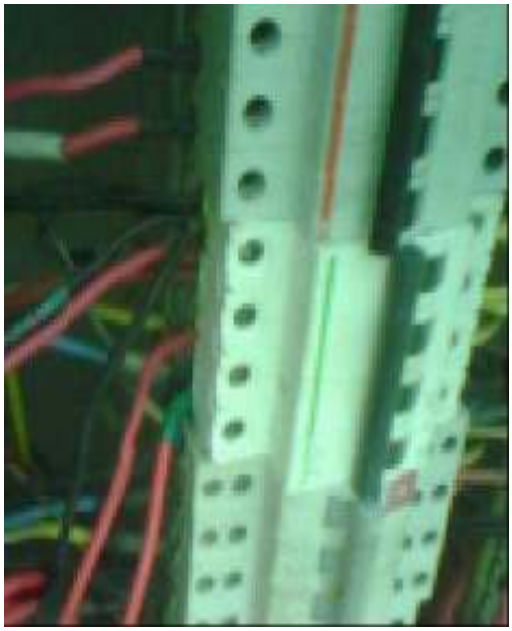

Visible Light Image

Image Info

Emissivity	0.95
Centerpoint	55.1°C

THANK YOU

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MANIPAL UNIVERSITY
JAIPUR

7 AFFORDABLE AND CLEAN ENERGY

Manipal University Jaipur Identifies and Tackles Energy Waste

In today's environmentally conscious world, adopting sustainable practices to reduce the carbon footprint is amongst the most impactful strategies. Energy consumption in educational institutions is a significant contributor to overall carbon emissions. Addressing energy waste is not only an ethical commitment but also a financial one. By identifying and rectifying energy inefficiencies, universities can reduce operational costs and redirect resources towards their core mission of education and research. Manipal University Jaipur has taken the initiative to undergo energy reviews, shedding light on where energy waste is highest. Manipal University Jaipur has embarked on a proactive journey to identify and mitigate energy waste on its campus. Their approach involves regular energy reviews conducted by dedicated teams of experts.

The process begins with comprehensive energy audits that encompass all aspects of the university's operations. These audits analyze energy consumption patterns in buildings, equipment, transportation, and more. Advanced technology, including data loggers and thermal imaging, is employed to gain precise insights. Data is the linchpin of Manipal University Jaipur's energy review process. It collects detailed data on energy usage, considering seasonal variations and peak demand periods. This data is then meticulously analyzed to pinpoint areas of high energy waste. Through thorough analysis, Manipal University Jaipur identifies the specific culprits of energy waste. These could include outdated equipment, inefficient building systems, or behavioral factors such as leaving lights on when not needed. Once the energy waste culprits are identified, the university's experts develop a set of targeted recommendations for improvement. These recommendations are presented in a detailed report, highlighting cost-effective solutions to increase energy efficiency. Manipal University Jaipur takes swift action to implement recommended efficiency measures. This could involve upgrading equipment to energy-efficient models, improving insulation, optimizing heating and cooling systems, and implementing lighting controls. Manipal University Jaipur does not stop at implementation. Continuous monitoring and data analysis are integral to ensuring that energy efficiency measures deliver the expected results. Real-time monitoring systems help identify any deviations from expected energy savings.

Manipal University Jaipur's dedication to identifying and addressing areas of energy waste through systematic energy reviews displays its leadership in the pursuit of sustainability. By reducing energy waste, the university lowers its operational costs and carbon footprint, contributing to a more environmentally responsible future.

7.1.6.1 The institutional initiatives to preserve and improve the environment and harness energy are confirmed through the following:

Green audit

The main objective of this project is to develop and propose recommendations for a lower carbon emission roadmap for the entire campus of Manipal University, based on the understanding of direct and indirect GHG emissions through energy use on the campus, energy monitoring, benchmarking of embodied energy for existing buildings, aligning the campus strategies with Sustainable development goals (SDGs), Energy Efficiency, renewable energy, and environmental performance.

Integrative Design Solution (IDSPL) has been appointed by MUJ to conduct the Green Audit for the campus covering the Energy and Environmental assessments along with the calculations of the Carbon footprint of the university.

Energy audit and green audit

Energy and Green Audit serve to identify opportunities for sustainable development practices, enhance environmental quality, improve health, hygiene, and safety, reduce liabilities, and save money. Energy& Green audits are a highly valuable tool for colleges in a wide range of ways to improve their environmental and economic performance reputation while reducing wastage and operating costs. Once baseline data is prepared after the auditing process, the data served as a point of departure for further action in campus greening. It helps the university to benchmark its programs and activities with other peer institutions, identify areas for improvement and prioritize the implementation of future projects. The data will also provide a basis for calculating the economic benefits of resource conservation projects by establishing the current rates of resource use and their associated costs.

Clean and green campus recognitions/ awards

Manipal University got the award named IGBC Performance Challenge 2022 in the educational category.

Beyond the campus activity

University has conducted various events on environmental promotional activities like; Tree Plantation in collaboration with NCC, “Cleanliness Awareness Program @ Govt. Sr. Sec. School, Begas”, “awareness about Environmental and Plantation drive with NGO Bhor”.

MANIPAL UNIVERSITY JAIPUR

7 AFFORDABLE AND CLEAN ENERGY

Manipal University Jaipur Programs Promote Energy Efficiency and Clean Energy Awareness

Energy efficiency and clean energy are central components in the battle against climate change. Reducing energy consumption and transitioning to clean energy sources are vital steps to mitigate the harmful effects of greenhouse gas emissions. For this reason, it is essential to educate communities on these topics to promote a more sustainable future. Universities play a pivotal role in disseminating knowledge and fostering awareness within their communities. Manipal University Jaipur has the resources, expertise, and infrastructure to spearhead initiatives that promote energy efficiency and clean energy. The benefits of these university-led initiatives extend beyond academia. When local communities become more energy-conscious and adopt cleaner energy practices, several positive outcomes emerge. Energy-efficient practices can lead to significant cost savings for homeowners and businesses, which can have a positive impact on the local economy. As communities become more engaged with clean energy, job opportunities in the renewable energy sector increase, contributing to local employment. Lower energy consumption and a shift to clean energy sources reduce the community's carbon footprint, leading to improved air and water quality and a healthier environment.

Manipal University Jaipur has established outreach programs that specifically target their local communities. These programs offer workshops, seminars, and information sessions to educate residents about energy-efficient practices, renewable energy technologies, and government incentives. Manipal University Jaipur conducts extensive research on energy efficiency and clean energy solutions. This research often extends to the local community, with Manipal University Jaipur collaborating with municipalities, businesses, and residents to implement innovative energy-saving technologies. Manipal University Jaipur is investing in renewable energy infrastructure on the campus. These installations serve as tangible examples of clean energy solutions and provide opportunities for community members to learn about renewable energy generation firsthand. Manipal University Jaipur offers degree programs and certificate courses related to energy efficiency and clean energy. These educational opportunities equip community members with the knowledge and skills needed to pursue careers in the renewable energy sector or implement energy-saving practices in their homes and businesses. Manipal University Jaipur is increasingly adopting sustainable practices in its operations, including energy-efficient building designs, recycling programs, and green transportation options. These initiatives set an example for the local community and encourage sustainable behaviors.

Manipal University Jaipur is more than an institution of higher learning; it is catalyst for change within the communities. Through their energy efficiency and clean energy programs, Manipal University Jaipur is empowering local residents and businesses to make informed choices that benefit both the environment and the economy.

Manipal University Jaipur

School of Civil & Chemical Engineering

Department of Civil Engineering

Department of Civil Engineering SCCE, had organized guest lecture for civil engineering students on *Waste Technology on Feacal Sludge and Septage Management (ODF++) - Experience Sharing* on 5th Nov. 2020. The key component of talks was water management, innovation in technology and implementation future opportunities in research and jobs. The lecture involves the skill development in technology and services sector ensuring best practice for public health and environment. Faculty members Mr Sagar Gupta, Assistant Professor civil engineering department, Dr Priyansha Mehra Associate Professor civil engineering department, Prof Anil Dutt Vyas Professor civil engineering department, Dr Meenakumari Sharma Associate Professor Head, civil engineering department planned and executed the event as per COVID protocol and advice issued by MUJ. Students took the advantage of the event through online participation, the list of participant and information shared with students are provided in the later part of the report.

1. Brochure of the programme

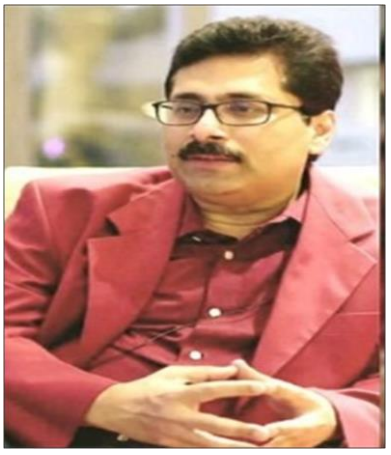
MANIPAL UNIVERSITY JAIPUR

Department of Civil Engineering

Organizing Guest Lecture

on

Feacal Sludge and Septage Management (ODF++) - Experience Sharing



Prof Srinivas Chary Vedala (Speaker)
Director, Administrative Staff College, India

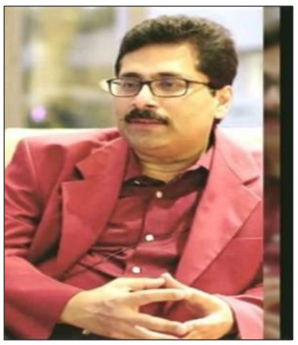
Time – 10:00 – 11:30 AM Date- 5th Nov. 2020

Venue - Microsoft Team (online)-

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjZjZDUyNjQtYTgzZi00ODRhLWE2YjktMDI5NGU5OGVhZWM2%40thread.v2/0?context=%7b%22Tid%22%3a%22a1608842-8390-4bfb-90af-89ae3ab30761%22%2c%22Oid%22%3a%22c1d5a06f-b9a1-42bf-8cfc-1ac406af790a%22%2c%22IsBroadcastMeeting%22%3atrue%7d

Professor Srinivas Chary Vedala is the Director at the Administrative Staff College of India (ASCI), a premier institution for public policy and capacity development in India.

2. Speaker Profile



Professor Srinivas Chary Vedala is the Director at the Administrative Staff College of India (ASCI), a premier institution for public policy and capacity development in India. He leads the Centre for Urban Governance and Environment which is recognized as a 'Centre of Excellence' by the Government of India. He is an urban environmental planner and public health engineer with over two decades of experience in urban infrastructure and service delivery. He specializes in water and environmental sanitation (WASH) services and his portfolio spans policy, programme, capacity development and knowledge management projects for national, state and city governments. He serves on various Inter-Ministerial and Department level Committees on WASH in schools, urban environmental sanitation, SWM, urban development. He supported the Ministry of Housing and Urban Affairs, Government of India by undertaking an independent appraisal of city development plans, reforms implementation and smart city proposals. He sits in various committees of Swachh Bharat Mission - Urban at GOI. He is also a committee member of the GOI's reinventing the toilet programme and national FSSM Alliance. He co-instituted the National Urban Water Awards programme with the Government of India (2008) to establish norms and accelerate performance improvement in municipal water and sanitation in India and has been the recipient of the Water for Life UN-Water Best Practices Award (4th edition) for its successful advocacy. He has also been conferred the Ashoka Fellowship for his innovations in the WASH sector. His current area of interest includes the provision of safe sanitation through non-sewer sanitation and faecal sludge management in Indian cities. He mentors start-ups associated with the circular economy, waste management and water supply

3. Screenshot from FDP

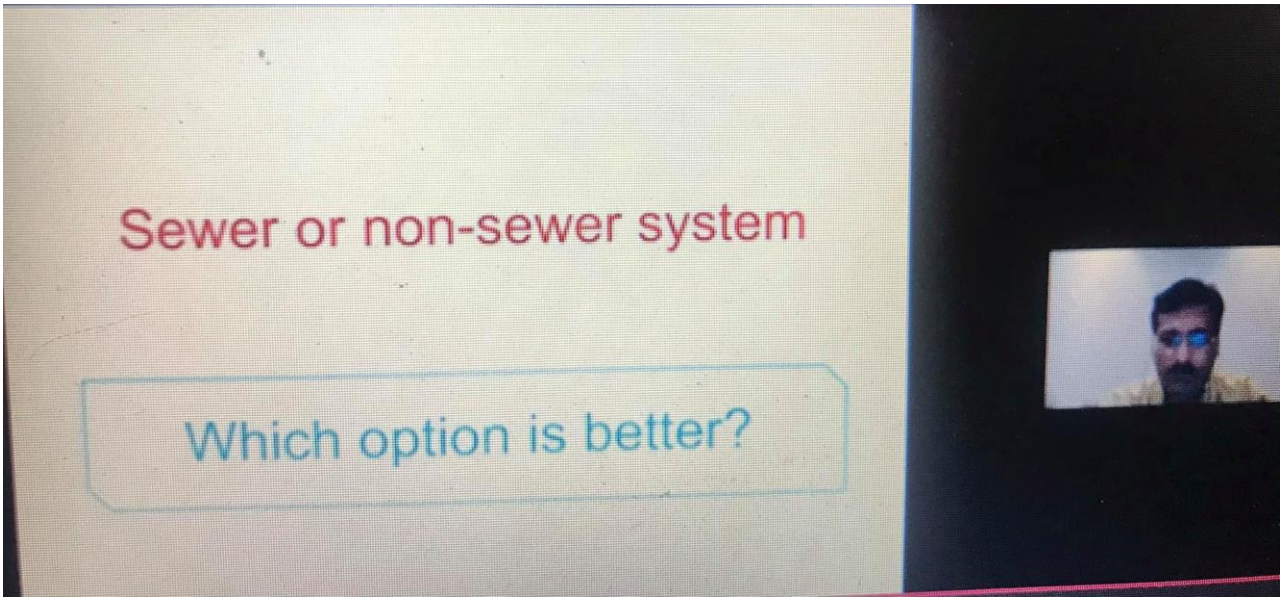


Fig no. 1 *Screenshot from Guest lecture on topic Feacal Sludge and Septage Management (ODF++) - Experience Sharing, ASCI*

4. List of Student

Sr.No.	Participant Id	Full Name
1	ayush.189102001@muj.manipal.edu	Ayush Jha
2	piyush.189102003@muj.manipal.edu	Piyush Morwal
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17	vikalp.189102022@muj.manipal.edu	Vikalp Kumar Singh
18	mrinal.189102023@muj.manipal.edu	Mrinal Shastri
19	yash.189402088@muj.manipal.edu	Yash Kumar Doharey
20	sachin.189102025@muj.manipal.edu	Sachin Kumar
21	mayank.189102026@muj.manipal.edu	Mayank Mishra
22	anannya.189102027@muj.manipal.edu	Anannya Shukla
23	udai.189102030@muj.manipal.edu	Udai Singh Kanwar
24	jaideep.189102032@muj.manipal.edu	Jaideep Singh Tulsi
25	archi.189102035@muj.manipal.edu	Archi Mudgal
26	rishabh.189102036@muj.manipal.edu	Rishabh Raj
27	dev.189102037@muj.manipal.edu	Dev Kamboj
28	madhav.189102038@muj.manipal.edu	Madhav Barodia
29	yashwardhan.189102043@muj.manipal.edu	Yashwardhan
30	benathung.189102044@muj.manipal.edu	Benathung Ezung
31	harsh.189102047@muj.manipal.edu	Harsh Srivastava
32	palak.189102048@muj.manipal.edu	Palak
33	aaditya.189102052@muj.manipal.edu	Lature Aaditya Sudhir
34	mohit.189102053@muj.manipal.edu	Mohit Chaudhary
35	sahil.189102054@muj.manipal.edu	Sahil Sharma
36	arjun.189102055@muj.manipal.edu	Shenvi Arjun Yogesh
37	abhishek.189102056@muj.manipal.edu	Abhishek Garg
38	vaibhav.189102057@muj.manipal.edu	Vaibhav Sharma
39	kartikey.189102058@muj.manipal.edu	Kartikey Singh Parihar
40	shubham.189102061@muj.manipal.edu	Shubham Chaturvedi
41	divyansh.189102062@muj.manipal.edu	Divyansh Totla
42	nikhil.189102063@muj.manipal.edu	Nikhil Srivastava
43	aditya.189102064@muj.manipal.edu	Aditya Kaplash
44	ankit.189102065@muj.manipal.edu	Ankit Kumar Amrit
45	dipankar.189102066@muj.manipal.edu	Dipankar Pegu
46	yash.189102067@muj.manipal.edu	Yash Goyal
47	bhawani.189102068@muj.manipal.edu	Bhawani Singh Deora
48	vishv.189102069@muj.manipal.edu	Vishv Narayan Meena
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50	danish.189102073@muj.manipal.edu	Danish Mushtaq Rather
51	pranav.189102074@muj.manipal.edu	Pranav Kaushik
52	atharva.189102076@muj.manipal.ed	Atharva Londhe

Manipal University Jaipur

School of Civil & Chemical Engineering

Department of Civil Engineering

Department of Civil Engineering SCCE, had organized guest lecture for civil engineering students on *Waste Technology on Issues and Challenges in Solid Waste Management* on 4th Nov. 2020. The key component of talks was water management, innovation in technology and implementation future opportunities in research and jobs. The lecture involves the skill development in technology and services sector ensuring best practice for public health and environment. Faculty members Mr Sagar Gupta, Assistant Professor civil engineering department, Dr Priyansha Mehra Associate Professor civil engineering department, Prof Anil Dutt Vyas Professor civil engineering department, Dr Meenakumari Sharma Associate Professor Head, civil engineering department planned and executed the event as per COVID protocol and advice issued by MUJ. Students took the advantage of the event through online participation, the list of participant and information shared with students are provided in the later part of the report.

1. Brochure of the programme

MANIPAL UNIVERSITY JAIPUR

Department of Civil Engineering

Organizing Guest Lecture

on

Issues and Challenges in Solid Waste Management

Dr Vivek Agarwal (Speaker)
Director, CDC Jaipur

Time – 2:00 – 3:00 PM Date- 4th Nov. 2020

Venue - Microsoft Team (online)-

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjZjZDUyNjQtYTgzZi00ODRhLWE2YjktMDI5NGU5OGVhZWM2%40thread.v2/0?context=%7b%22Tid%22%3a%22a1608842-8390-4bfb-90af-89ae3ab30761%22%2c%22Oid%22%3a%22c1d5a06f-b9a1-42bf-8cfc-1ac406af790a%22%2c%22IsBroadcastMeeting%22%3atrue%7d

Dr Vivek S Agrawal, Leading waste management professional, heading Centre for Development Communication Trust and Managing Director of Kanak Resources Management Limited (a subsidiary of IL&FS Environmental Infrastructure and Services Limited), has been elected as the Chairman of International Solid Waste Association Working Group on Collection and Transportation Technology.

2. Speaker Profile

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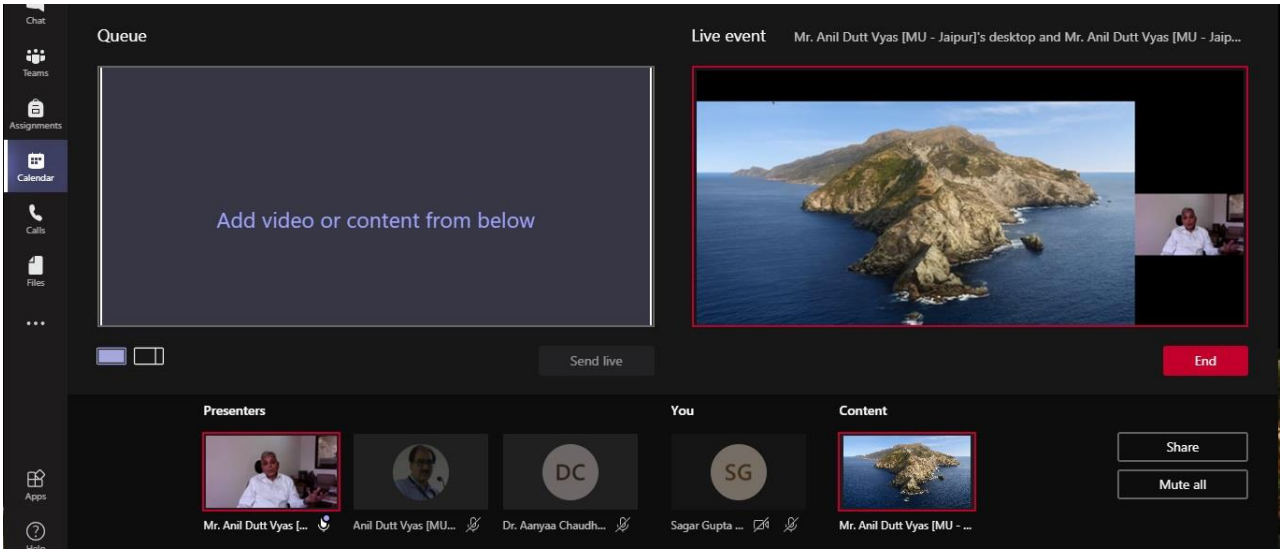

Fig no. 1 *Screenshot from Guest lecture on topic Issues and Challenges in Solid Waste Management*

4. List of Student

Sr.No.	Participant Id	Full Name
1	ayush.189102001@muj.manipal.edu	Ayush Jha
2	piyush.189102003@muj.manipal.edu	Piyush Morwal
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4	romir.189102006@muj.manipal.edu	Romir Vinayak More
5	umair.189102007@muj.manipal.edu	Umair Ahmad
6	shreyash.189102008@muj.manipal.edu	Shreyash Singh
7	prajjal.189102010@muj.manipal.edu	Prajjal Chowdhury
8	uddeshya.189102011@muj.manipal.edu	Uddeshya Pratap Singh Sengar
9	omprakash.189102013@muj.manipal.edu	C Omprakash
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11	vasu.189102015@muj.manipal.edu	Vasu Bhargava
12	anamika.189102016@muj.manipal.edu	Anamika Anil
13	adarsh.189102019@muj.manipal.edu	Adarsh Kumar Singh
14	kavita.189102020@muj.manipal.edu	Kavita Choudhary
15	saurav.189102021@muj.manipal.edu	Saurav Singh Badal
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20	sachin.189102025@muj.manipal.edu	Sachin Kumar
21	mayank.189102026@muj.manipal.edu	Mayank Mishra
22	anannya.189102027@muj.manipal.edu	Anannya Shukla
23	udai.189102030@muj.manipal.edu	Udai Singh Kanwar
24	jaideep.189102032@muj.manipal.edu	Jaideep Singh Tulsi
25	archi.189102035@muj.manipal.edu	Archi Mudgal
26	rishabh.189102036@muj.manipal.edu	Rishabh Raj
27	dev.189102037@muj.manipal.edu	Dev Kamboj
28	madhav.189102038@muj.manipal.edu	Madhav Barodia
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30	benathung.189102044@muj.manipal.edu	Benathung Ezung
31	harsh.189102047@muj.manipal.edu	Harsh Srivastava
32	palak.189102048@muj.manipal.edu	Palak
33	aaditya.189102052@muj.manipal.edu	Lature Aaditya Sudhir
34	mohit.189102053@muj.manipal.edu	Mohit Chaudhary
35	sahil.189102054@muj.manipal.edu	Sahil Sharma
36	arjun.189102055@muj.manipal.edu	Shenvi Arjun Yogesh
37	abhishek.189102056@muj.manipal.edu	Abhishek Garg
38	vaibhav.189102057@muj.manipal.edu	Vaibhav Sharma
39	kartikey.189102058@muj.manipal.edu	Kartikey Singh Parihar
40	shubham.189102061@muj.manipal.edu	Shubham Chaturvedi
41	divyansh.189102062@muj.manipal.edu	Divyansh Totla
42	nikhil.189102063@muj.manipal.edu	Nikhil Srivastava
43	aditya.189102064@muj.manipal.edu	Aditya Kaplash
44	ankit.189102065@muj.manipal.edu	Ankit Kumar Amrit
45	dipankar.189102066@muj.manipal.edu	Dipankar Pegu
46	yash.189102067@muj.manipal.edu	Yash Goyal
47	bhawani.189102068@muj.manipal.edu	Bhawani Singh Deora
48	vishv.189102069@muj.manipal.edu	Vishv Narayan Meena
49	digvijay.189102072@muj.manipal.edu	Digvijay Singh Yadav
50	danish.189102073@muj.manipal.edu	Danish Mushtaq Rather
51	pranav.189102074@muj.manipal.edu	Pranav Kaushik
52	atharva.189102076@muj.manipal.ed	Atharva Londhe

Manipal University Jaipur

School of Civil & Chemical Engineering

Department of Civil Engineering

Department of Civil Engineering SCCE, had organized guest lecture for civil engineering students on *Waste Technology on business models for faecal sludge management* on 4th Nov. 2020. The key component of talks was water management, innovation in technology and implementation future opportunities in research and jobs. The lecture involves the skill development in technology and services sector ensuring best practice for public health and environment. Faculty members Mr Sagar Gupta, Assistant Professor civil engineering department, Dr Priyansha Mehra Associate Professor civil engineering department, Prof Anil Dutt Vyas Professor civil engineering department, Dr Meenakumari Sharma Associate Professor Head, civil engineering department planned and executed the event as per COVID protocol and advice issued by MUJ. Students took the advantage of the event through online participation, the list of participant and information shared with students are provided in the later part of the report.

1. Brochure of the programme

MANIPAL UNIVERSITY JAIPUR

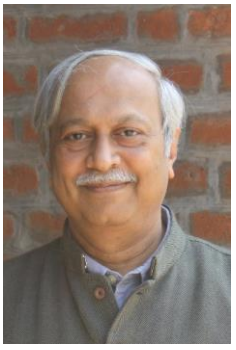
MANIPAL UNIVERSITY JAIPUR

Department of Civil Engineering

Organizing Guest Lecture

on

Business Models for Faecal Sludge Management



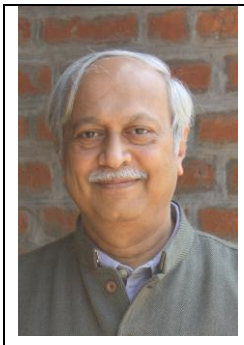
Prof Dinesh Mehta (Speaker)
Professor Emeritus at CEPT University

Time – 3:00 PM– 4:30 PM Date- 4th Nov. 2020

Venue - Microsoft Team (online)-
https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjZjZDUyNjQtYTgzZi00ODRhLWE2YjktMDI5NGU5OGVhZWM2%40thread.v2/0?context=%7b%22Tid%22%3a%22a1608842-8390-4bfb-90af-89ae3ab30761%22%2c%22Oid%22%3a%22c1d5a06f-b9a1-42bf-8cfc-1ac406af790a%22%2c%22IsBroadcastMeeting%22%3atrue%7d

Prof. Dinesh Mehta is a Professor Emeritus at CEPT University, Ahmedabad, where he teaches urban management, urban finance and development planning.

2. Speaker Profile



Prof. Dinesh Mehta is a Professor Emeritus at CEPT University, Ahmedabad, where he teaches urban management, urban finance and development planning. He was the Director of School of Planning, CEPT, Director of the National Institute of Urban Affairs, New Delhi, India, head of urban management programme at UN-HABITAT, Nairobi. Dr. Mehta has a Ph.D. from University of Pennsylvania, a Masters in City and Regional Planning from Harvard University, and a Bachelor of Technology in Civil Engineering, from IIT Madras, India.

3. Screenshot from FDP

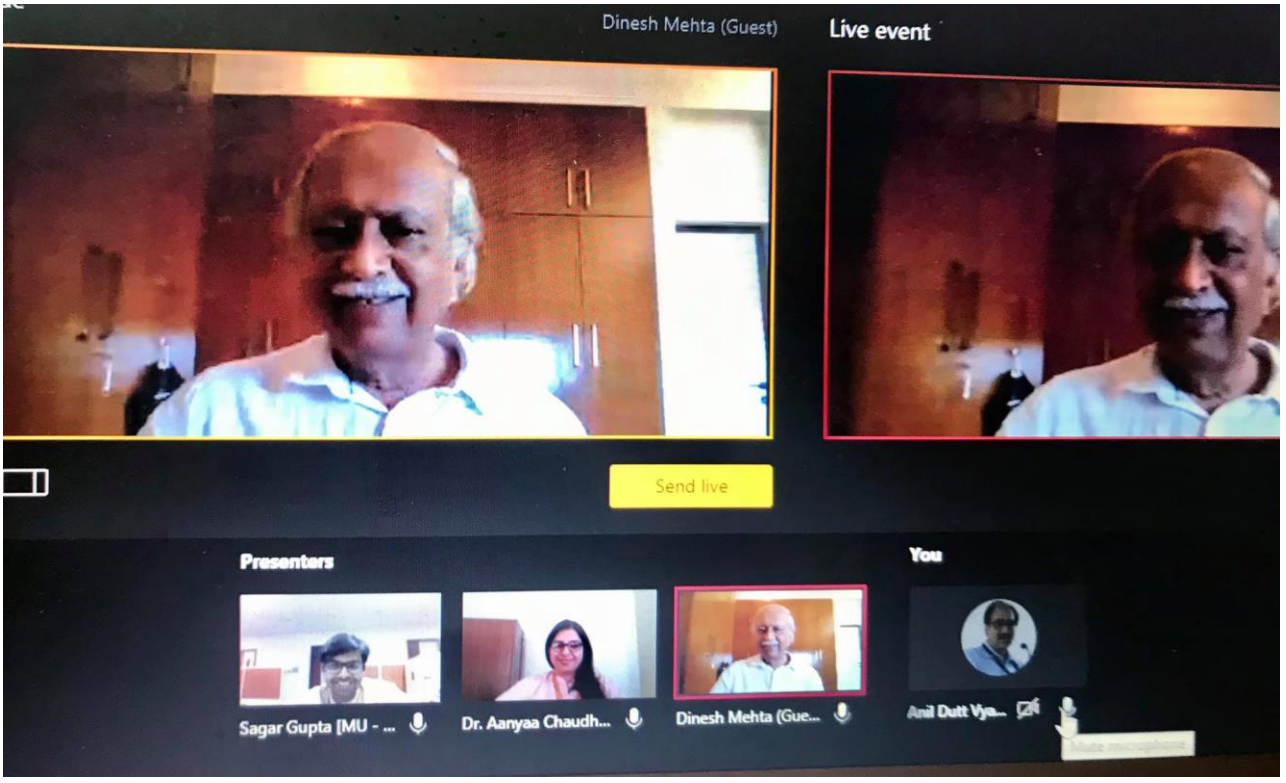


Fig no. 1 *Screenshot from Guest lecture on topic business models for faecal sludge management, CEPT*

4. List of Student

Sr.No.	Participant Id	Full Name
1	ayush.189102001@muj.manipal.edu	Ayush Jha
2	piyush.189102003@muj.manipal.edu	Piyush Morwal
3	rakshit.189102005@muj.manipal.edu	Rakshit Joshi
4	romir.189102006@muj.manipal.edu	Romir Vinayak More
5	umair.189102007@muj.manipal.edu	Umair Ahmad
6	shreyash.189102008@muj.manipal.edu	Shreyash Singh
7	prajjal.189102010@muj.manipal.edu	Prajjal Chowdhury
8	uddeshya.189102011@muj.manipal.edu	Uddeshya Pratap Singh Sengar
9	omprakash.189102013@muj.manipal.edu	C Omprakash
10	manvendra.189102014@muj.manipal.edu	Manvendra Singh Thakur
11	vasu.189102015@muj.manipal.edu	Vasu Bhargava

12	anamika.189102016@muj.manipal.edu	Anamika Anil
13	adarsh.189102019@muj.manipal.edu	Adarsh Kumar Singh
14	kavita.189102020@muj.manipal.edu	Kavita Choudhary
15	saurav.189102021@muj.manipal.edu	Saurav Singh Badal
16	shubh.189201029@muj.manipal.edu	Shubh Sarthak Singh
17	vikalp.189102022@muj.manipal.edu	Vikalp Kumar Singh
18	mrinal.189102023@muj.manipal.edu	Mrinal Shastri
19	yash.189402088@muj.manipal.edu	Yash Kumar Doharey
20	sachin.189102025@muj.manipal.edu	Sachin Kumar
21	mayank.189102026@muj.manipal.edu	Mayank Mishra
22	anannya.189102027@muj.manipal.edu	Anannya Shukla
23	udai.189102030@muj.manipal.edu	Udai Singh Kanwar
24	jaideep.189102032@muj.manipal.edu	Jaideep Singh Tulsi
25	archi.189102035@muj.manipal.edu	Archi Mudgal
26	rishabh.189102036@muj.manipal.edu	Rishabh Raj
27	dev.189102037@muj.manipal.edu	Dev Kamboj
28	madhav.189102038@muj.manipal.edu	Madhav Barodia
29	yashwardhan.189102043@muj.manipal.edu	Yashwardhan
30	benathung.189102044@muj.manipal.edu	Benathung Ezung
31	harsh.189102047@muj.manipal.edu	Harsh Srivastava
32	palak.189102048@muj.manipal.edu	Palak
33	aaditya.189102052@muj.manipal.edu	Lature Aaditya Sudhir
34	mohit.189102053@muj.manipal.edu	Mohit Chaudhary
35	sahil.189102054@muj.manipal.edu	Sahil Sharma
36	arjun.189102055@muj.manipal.edu	Shenvi Arjun Yogesh
37	abhishek.189102056@muj.manipal.edu	Abhishek Garg
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48	vishv.189102069@muj.manipal.edu	Vishv Narayan Meena
49	digvijay.189102072@muj.manipal.edu	Digvijay Singh Yadav
50	danish.189102073@muj.manipal.edu	Danish Mushtaq Rather
51	pranav.189102074@muj.manipal.edu	Pranav Kaushik
52	atharva.189102076@muj.manipal.ed	Atharva Londhe

Manipal University Jaipur

School of Civil & Chemical Engineering

Department of Civil Engineering

Department of Civil Engineering SCCE, had organized guest lecture for civil engineering students on *Waste Technology on Selection of Proper Waste Technology as part of Waste Management Infrastructure* on 2nd Nov. 2020. The key component of talks was water management, innovation in technology and implementation future opportunities in research and jobs. The lecture involves the skill development in technology and services sector ensuring best practice for public health and environment. Faculty members Mr Sagar Gupta, Assistant Professor civil engineering department, Dr Priyansha Mehra Associate Professor civil engineering department, Prof Anil Dutt Vyas Professor civil engineering department, Dr Meenakumari Sharma Associate Professor Head, civil engineering department planned and executed the event as per COVID protocol and advice issued by MUJ. Students took the advantage of the event through online participation, the list of participant and information shared with students are provided in the later part of the report.

1. Brochure of the programme

MANIPAL UNIVERSITY JAIPUR

Department of Civil Engineering

Organizing Guest Lecture

on

Waste Technology on Advances in Sewage Treatment: Issues and challenges with a focus on its reuse in irrigation

Dr Akhilender Bhushan Gupta
(Speaker)
Professor, MNIT Jaipur

me – 10:00 – 11:00 AM Date- 2nd Nov. 2020

enue - Microsoft Team (online)-

https://teams.microsoft.com/l/meetup-join/19%3ameeting_NjZjZDUyNjQtYTgzZi00ODRhLWE2YjktMDI5NGU5OGVhZWM2%40thread.v2/0?context=%7b%22Tid%22%3a%22a1608842-8390-4bfb-90af-89ae3ab30761%22%2c%22Oid%22%3a%22c1d5a06f-b9a1-42bf-8cfc-1ac406af790a%22%2c%22IsBroadcastMeeting%22%3atrue%7d

·. A. B. Gupta is presently professor in the Department of civil engineering, MNIT Jaipur.

2. Speaker Profile

Dr. A. B. Gupta is presently professor in the Department of civil engineering, MNIT Jaipur. He holds B.E. (Civil) from MREC Jaipur; M. Tech. and PhD (Environmental Science and Engineering) degrees from CESE, IIT Bombay. He joined MNIT as a lecturer of Civil Engineering in 1984 and is serving as a Professor since 1996. His assignments include HOD (Civil), Dean R&D, Dean (Faculty Affairs) and Director of the institute. He has published/presented over 400 papers in various international/national journals/conferences, guided twelve PhDs and about 100 Masters' theses, taken up several research/consultation projects, and received several academic awards. He has been a non official member of RPCB and Environment and Health Board of Rajasthan State and important committees of DST, GOI.

3. Screenshot from FDP

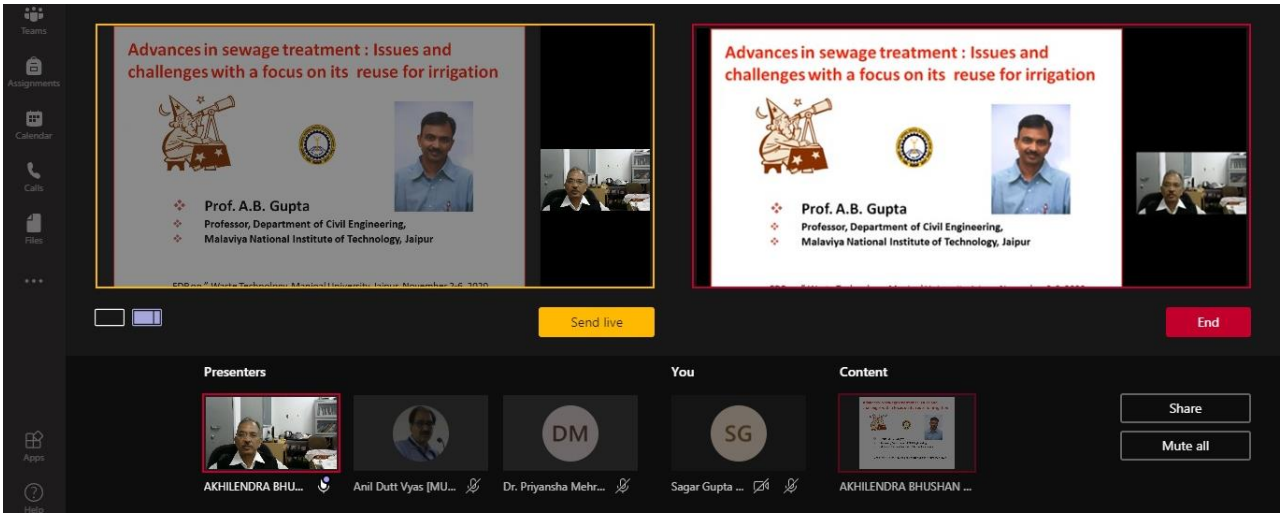

Fig no. 1 *Screenshot from Guest lecture on topic of Waste Technology on Advances in Sewage Treatment: Issues and challenges with a focus on its reuse in irrigation ,MNIT Jaipur*

4. List of Student

Sr.No.	Participant Id	Full Name
1	ayush.189102001@muj.manipal.edu	Ayush Jha
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MANIPAL UNIVERSITY
JAIPUR

Climate change is a waste management problem

Climate change is mainly related with the waste management problems. The physical problem underlying climate changes is the dumping of carbon dioxide and other greenhouse gases into the air and consecutively causes global warming. Carbon dioxide is a waste product therefore waste management impact on climate change. To enhance the knowledge of students towards climate change by using different waste management techniques, department of civil engineering has organized one faculty development program and series of expert lectures in waste management domain. The list of webinars and the related report of these activities are mentioned below.

1. Organized faculty development program on Waste Management during 2-6 November, 2020.
2. Expert lecture on "Community based research interventions n environmental science and engineering: the key to a sustainable and healthy society" by Prof. A.B.Gupta, from MNIT Jaipur.
3. Expert lecture on "Selection of Proper Waste Technology as part of Waste Management Infrastructure" by Prof Brajesh Dubey from IIT Kharagpur
4. Expert lecture on "Waste Technology on Feacal Sludge and Septage Management (ODF++)" by Prof Srinivas Chary Vedala, Director, Administrative Staff College, India
5. Waste Technology on business models for faecal sludge management" by Prof Dinesh Mehta, Professor Emeritus at CEPT University
6. Expert lecture on "*Waste Technology on Selection of Proper Waste Technology as part of Waste Management Infrastructure*" by Prof. A.B.Gupta, from MNIT Jaipur.

MANIPAL UNIVERSITY
JAIPUR

CHIEF PATRON

Dr G K Prabhu
(President, MUJ)

PATRON

Dr N N Sharma
(Pro President, MUJ)

Dr H Ravishankar
Kamath (Registrar, MUJ)

ADVISORY COMMITTEE

Dr Jagannath Korody
(Dean FoE)

Dr Bhavna Tripathi
(Director, SCCE)

Dr Meena Kumari Sharma
(HoD, Dept of Civil
Engineering)

Date: 2-6th November 2020
Venue: Online Mode:
Manipal University Jaipur

Manipal University Jaipur

MANIPAL UNIVERSITY JAIPUR

ORGANIZES

FACULTY DEVELOPMENT PROGRAM ON WASTE TECHNOLOGY

IN
ASSOCIATION WITH

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

HIGHLIGHTS

- Eminent Speakers from Industries IITs, NITs and other Leading Academic Institutions.
- Interaction with India's leading Waste Technology Experts.

COORDINATOR

Prof Anil Dutt Vyas
(Civil Engineering)

Dr Abhishek Sharma
(Chemical Engineering)

Dr Aanyaa Chaudhary
(TAPMI School of Business)

DEPUTY COORDINATOR

Dr Priyansha Mehra
(Civil Engineering)

Mr Sagar Gupta
(Civil Engineering)

SPEAKERS

Prof. A B Gupta (MNIT, Jaipur)
Dr V S Chary (ASCI, Hyderabad)
Prof A A Kazmi (IIT Roorkee)
Prof Brajesh Dubey (IIT, Kharagpur)
Prof Jyoti Prakash (IIT, Mumbai)
Prof Makrand Gangrekar (IIT, Kharagpur)
Dr Vivek Agarwal (Director CDC, Jaipur)
Dr R C Gaur (Retired Pro-VC RU)
Dr Vishhwanath S (India's Lead Expert, Bengaluru)
Prof Malini Reddy (ASCI, Hyderabad)
Prof Sanjay Mathur (MNIT, Jaipur)
Prof Urmila Bhrigu (MNIT, Jaipur)
Dr Dinesh Mehta (CEPT, Ahmedabad)
Dr Meera Mehta (CEPT, Ahmedabad)
Dr Srikant Munturi (BITS, Goa)
Dr Nivedita Kaul (MNIT, Jaipur)
Dr Meena Kumari Sharma (MUJ, Jaipur)
Dr Abhishek Sharma (MUJ, Jaipur)
Dr Monika Sogani (MUJ, Jaipur)
Dr Aanyaa Chaudhary (MUJ, Jaipur)

- No fees for Participants
- Certificate on successful completion

REGISTRATION LINK:
https://atalacademy.aicte-india.org/login

1. Register as a participant → Fill your details
2. Select workshop: Rajasthan → Month → November → Thrust Area → Engineering : Waste Technology → Online Mode
3. Select Institute → Manipal University Jaipur

CONTACT US

Dr Priyansha Mehra
priyansha.mehra@jaipur.manipal.edu

Prof Anil Dutt Vyas
anildutt.vyas@jaipur.manipal.edu

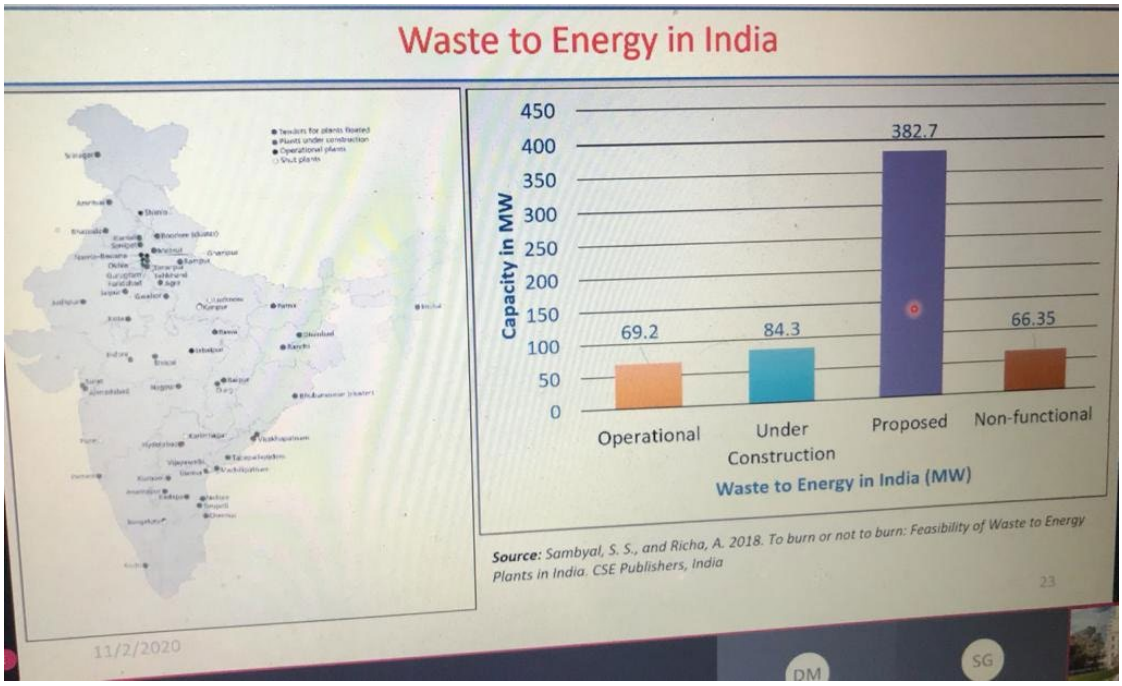
MANIPAL UNIVERSITY
JAIPUR

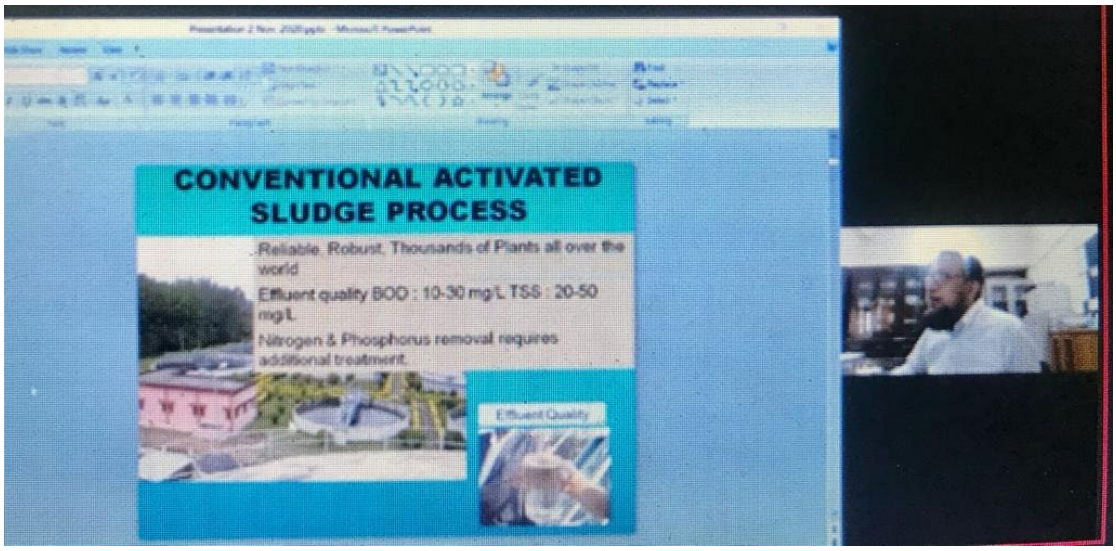
Faculty Development Program
Waste Management
2-6 November, 2020

Name of Resource Person	Institution	Presentation time	Topic of presentation
2 nd November			
Dr G K Prabhu	President, MUJ	9.30 am- 10:00 am	Presidential Address
Prof A B Gupta	MNIT, Jaipur	10 am-11.30 am	Advances in sewage treatment : Issues and challenges with a focus on its reuse for irrigation
Prof Brajesh Dubey	IIT, Kharagpur	11.45 am-1.15 pm	Selection of Proper Waste Technology as part of Waste Management Infrastructure.
Prof A A Kazmi	IIT, Roorkee	1.45 pm-3.15 pm	Advanced technologies in sewage treatment
Dr Aaanya Choudhary	MUJ,Jaipur	3.30 pm-4.30 pm	Emotional Intelligence at Work Place
3 rd November			
Dr Vishhvanath S	India's lead expert, Bengaluru	10 am-11.30 am	Wastewater management in a metropolis Policies , Practices and Challenges in Bengaluru
Prof Jyoti Prakash	IIT,Mumbai	11.45 am-1.15 pm	Waste Water Technologies
Dr Nivedita Kaul	MNIT,Jaipur	1.45 pm-3.15 pm	Advancements in solid waste management techniques
Dr R C Gaur	Retired RU and MUJ, Jaipur	3.30 pm-5.00 pm	Feasibility of waste water treatment systems
4 th November			
Prof Makrand Gangrekar	IIT Kharagpur	10 am-11.30 am	Exploiting bio-electrochemical systems to facilitate producing reusable quality treated water and resource recovery
Prof Sanjay Mathur	MNIT, Jaipur	11.45 am-1.15 pm	Decentralized Waste water Treatment.
Dr Vivek Agarwal	Director CDC, Jaipur	1.45 pm-3.15 pm	Solid Waste Management Technologies
Dr Dinesh Mehta	CEPT, Ahmedabad	3.30 pm-5.00 pm	Sanitation Financing
5 th November			
Dr V S Chary,	Director, ASCI, Hyderabad	10 am-11.30 am	GOI Priority areas
Prof Urmila Bhrigu	MNIT, Jaipur	11.45 am-1.15 pm	Waste Technologies
Dr Srikant Munturi	BITS,Goa	1.45 pm-3.15 pm	Wastewater treatment and epidemiology.
Prof Malini Reddy	ASCI, Hyderabad	3.30 pm-5.00 pm	City wide inclusive sanitation - principles and applications in India
6 th November			
Dr Meena Sharma	HoD Civil	10 am-11.30 am	Role of low cost on site sanitation systems with future prospects
Prof Abhishek Sharma	MUJ, Jaipur	11.45 am-1.15 pm	Waste to Resources- Valorization Process for Circular Economy
Dr Monika Sogani	MUJ, Jaipur	1.45 pm-3.15 pm	Delawas: A case study on Waste to Energy.
Participants Online Test		3.30 pm-5.00 pm	
Feedback Form		3.30 Pm-3.45 PM	
Closing and Valedictory			
Dr R S Kamath	Registrar,MUJ	4.00 PM Onwards	
Prof Jagannath Korody	Dean FOE	4.15 Pm onwards	
Prof Bhanvna Tripathi	Director SCCE	4.30 pm onwards	
Dr Meena Sharma	HoD Civil	4.45 Pm onwards	


Advances in sewage treatment : Issues and challenges with a focus on its reuse for irrigation
Prof. A.B. Gupta
Professor, Department of Civil Engineering,
Malaviya National Institute of Technology, Jaipur
FDP on " Waste Technology, Manipal University, Jaipur, November 2-6, 2020

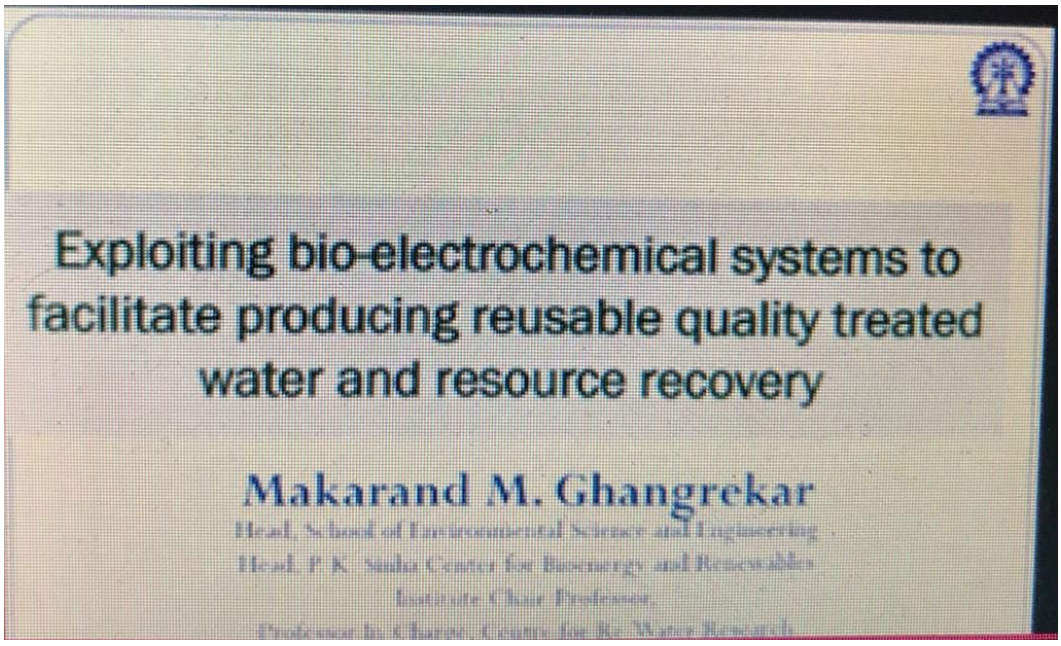

Selection of Proper Treatment Technology
for Waste Management Infrastructure
Manipal University, Jaipur
Brajesh K Dubey, PhD, C.Eng, FIE
Environmental Engineering and Management Division
Department of Civil Engineering
LIVE
02:42:02
Request control
Indian Institute of Technology Kharagpur


Waste to Energy in India
450
400
350
300
250
200
150
100
50
0
Capacity in MW
69.2
84.3
382.7
66.35
Operational
Under Construction
Proposed
Non-functional
Waste to Energy in India (MW)
Source: Sambyal, S. S., and Richa, A. 2018. To burn or not to burn: Feasibility of Waste to Energy Plants in India. CSE Publishers, India
23
11/2/2020
DM
SG


CONVENTIONAL ACTIVATED SLUDGE PROCESS
Reliable, Robust, Thousands of Plants all over the world
Effluent quality BOD : 10-30 mg/L TSS : 20-50 mg/L
Nitrogen & Phosphorus removal requires additional treatment.
Effluent Quality


Live event
Vishwanath Srikantaiah (Guest)'s desktop and Vishwanath Srikantaiah (Guest)...
Wastewater reuse for drinking
FINAL IMPLEMENTATION
STP Treatment Plant
Sand Filter
Carbon Filter
Chlorine
Sand Filter
Activated Carbon Filter
Ozonizer
RO System


ADVANCEMENT IN SOLID WASTE MANAGEMENT PRACTICES
Dr. Nivedita Kaul,
Associate Professor,


Exploiting bio-electrochemical systems to facilitate producing reusable quality treated water and resource recovery
Makarand M. Ghangrekar


Field scale portable bioelectric toilet

MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

BRIEF REPORT OF EXPERT LECTURE

Topic: Community based research interventions n environmental science and engineering: the key to a sustainable and healthy society

Date: 19.03.2021

Time: 16:30 – 18:00 PM

Speaker: Prof. A. B. Gupta, Professor, Civil Engineering, MNIT Jaipur

Convener: Mr. Sagar Gupta

Organizing Department: Civil Engineering, MUJ

Brochure:

Meeting Link on MS-Teams:
https://teams.microsoft.com/l/meetup-join/19%3a1ca8723d67e14004932e3fa3ba583c6b%40thread.tacv2/1616667260045?context=%7b%22Tid%22%3a%22a1608842-8390-4bfb-90af-89ae3ab30761%22%2c%22Oid%22%3a%2212872b89-6a8b-488b-8257-fd8cb6831c27%22%7d

Description

The Department of Civil Engineering, Manipal University Jaipur proudly announces a guest Lectures on 19th March 2021 from 16:30 AM – 18:00 PM. Eminent professors of MNIT Jaipur delivered a lecture on Community based research interventions n environmental science and engineering: the key to a sustainable and healthy society.

Dr. A. B. Gupta is presently professor in the Department of civil engineering, MNIT Jaipur. He holds B.E. (Civil) from MREC Jaipur; M. Tech. and PhD (Environmental Science and Engineering) degrees from CESE, IIT Bombay. He joined MNIT as a lecturer of Civil Engineering in 1984 and is serving as a Professor since 1996. His assignments include HOD (Civil), Dean R&D, Dean (Faculty Affairs) and Director of the institute. He has published/presented over 400 papers in various international/national journals/conferences,

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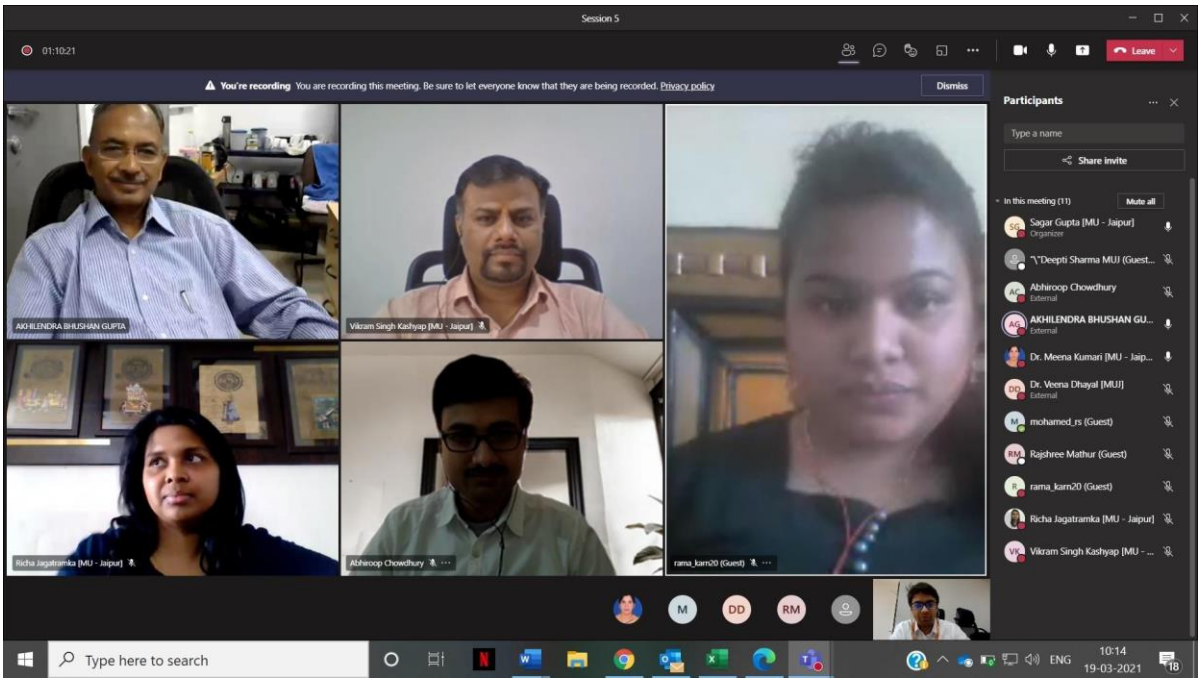


Picture: Prof. A.B.Gupta sharing his research work in his lecture and interaction with our students and faculty members

LIST OF PARTICIPANTS					
Sl No	**Name**	**Sl No**	**Name**	**Sl No**	**Name**
1	Aaditya Sudhir Lature [MUJ]	33	Govind Gupta [MUJ]	65	Razeena Arshi [MUJ]
2	Aakanksha Singh [MUJ]	34	Harshamajety [MUJ]	66	Rinku [MUJ]
3	Aayush Mathur [MUJ]	35	Hemant Singh Jadoun [MUJ]	67	Rishi Menon [MUJ]
4	Abhishek Garg [MUJ]	36	Hemant Singh Rathore [MUJ]	68	Rohaan Sawant [MUJ]
5	Adarsh Kumar Singh [MUJ]	37	Jabbar Khan [MUJ]	69	Rohit Kachhawaha [MUJ]
6	Aditya Saini [MUJ]	38	Jaideep Singh Tulsi [MUJ]	70	Romir Vinayak More [MUJ]
7	Akash Sunny [MUJ]	39	Jimmy Sethna [Guest]	71	Sachin Kumar [MUJ]
8	Anamika Anil [MUJ]	40	Jyoti Yadav [MUJ]	72	Sahil [University of Rajasthan]
9	Anamika Anil [MUJ]	41	Kamal Kumar [MUJ]	73	Saidu Madhu Praneetha [MUJ]
10	Anannya Shukla [MUJ]	42	Kartikey Singh Parihar [MUJ]	74	Samal Dipak [Guest]
11	Ananya Dhar [MUJ]	43	Kuldeep Tiwari [Vivekananda Global University]	75	Sanchit Anand [MUJ]
12	Ar. Sunanda Kapoor [MUJ]	44	Madhav.Barodia [MUJ]	76	Sandeep Kumar [MUJ]
13	Archi Mudgal [MUJ]	45	Madhur Kalal [MUJ]	77	Saurav Singh Badal [MUJ]
14	Arjun Yogesh Shenvi [MUJ]	46	Mayank Misra [MUJ]	78	Shaik Hussain [MUJ]
15	Atharva Londhe [MUJ]	47	Mr Anil Dutt Vyas [MUJ]	79	Shubh Sarthak Singh [MUJ]
16	Ayush Jha [MUJ]	48	Mr Vikram Singh Kashyap [MUJ]	80	Shubham Chaturvedi [MUJ]
17	Babulal Choudhary [MUJ]	49	Mrinal Shastri [MUJ]	81	Shubham Rawat [MUJ]
18	Benathung Ezung [MUJ]	50	Mukesh Kumar Verma [MUJ]	82	Siddharth Bala [MUJ]
19	Bhawani Singh Deora [MUJ]	51	N. Vyjayanthi [Guest]	83	Siddharth Bala [MUJ]
20	Danish Mushtaq Rather [MUJ]	52	Nandlal Chaturvedi [MUJ]	84	Sourav Kumar Das [MUJ]
21	Dave Deepa [Guest]	53	Nikhil Herenj [MUJ]	85	Srikar A Chowdary [MUJ]
22	Digvijay Singh Yadav [MUJ]	54	Nikhil Srivastava [MUJ]	86	Suheil Ahamed Qureshi [MUJ]
23	Dipankar Pegu [MUJ]	55	Omprakash Chilakala [MUJ]	87	Suheil Ahamed Qureshi [MUJ]
24	Divyansh Totla [MUJ]	56	Pankaj Dargar [MUJ]	88	Udai Singh Kanwar [MUJ]
25	Dr Bhavna Tripathi [MUJ]	57	Prajjal Chowdhury [MUJ]	89	Uddeshya Pratap Singh [MUJ]
26	Dr Gaurav Sancheti [MUJ]	58	Prajjal Chowdhury [MUJ]	90	Vasu Bhargava [MUJ]
27	Dr Gaurav Sancheti [MUJ]	59	Pranab Pratik [MUJ]	91	Venice Palak [MUJ]
28	Dr Jagannath Korody [MUJ]	60	Mrs Prathibha A [Others]	92	Vikalp Kumar Singh [MUJ]
29	Dr Meena Kumari [MUJ]	61	Prof Anjana Vyas [Guest]	93	Vishnu Kumar Kumawat [MUJ]
30	Dr Priyansha Mehra [MUJ]	62	Raghuvesh Tiwary [MUJ]	94	Vishv Narayan Meena [MUJ]
31	Dr Tej Bahadur [MUJ]	63	Rakshit Joshi [MUJ]	95	Yash Totla [MUJ]
32	Firoz Alam Faroque [MUJ]	64	Ramakant Jounliya [MUJ]	96	Yashwardhan [MUJ]

BRIEF PROFILE OF RESOURCE PERSON	
	**Prof A. B.Gupta** Dr. A. B. Gupta is presently professor in the Department of civil engineering, MNIT Jaipur. He holds B.E. (Civil) from MREC Jaipur; M. Tech. and PhD (Environmental Science and Engineering) degrees from CESE, IIT Bombay. He joined MNIT as a lecturer of Civil Engineering in 1984 and is serving as a Professor since 1996. His assignments include HOD (Civil), Dean R&D, Dean (Faculty Affairs) and Director of the institute. He has published/presented over 400 papers in various international/national journals/conferences,

(Dr. Meena Kumari)
Head, Civil Engineering

MANIPAL UNIVERSITY JAIPUR

7 AFFORDABLE AND CLEAN ENERGY

Manipal University Jaipur's Public Pledge towards 100% Renewable Energy Beyond Campus

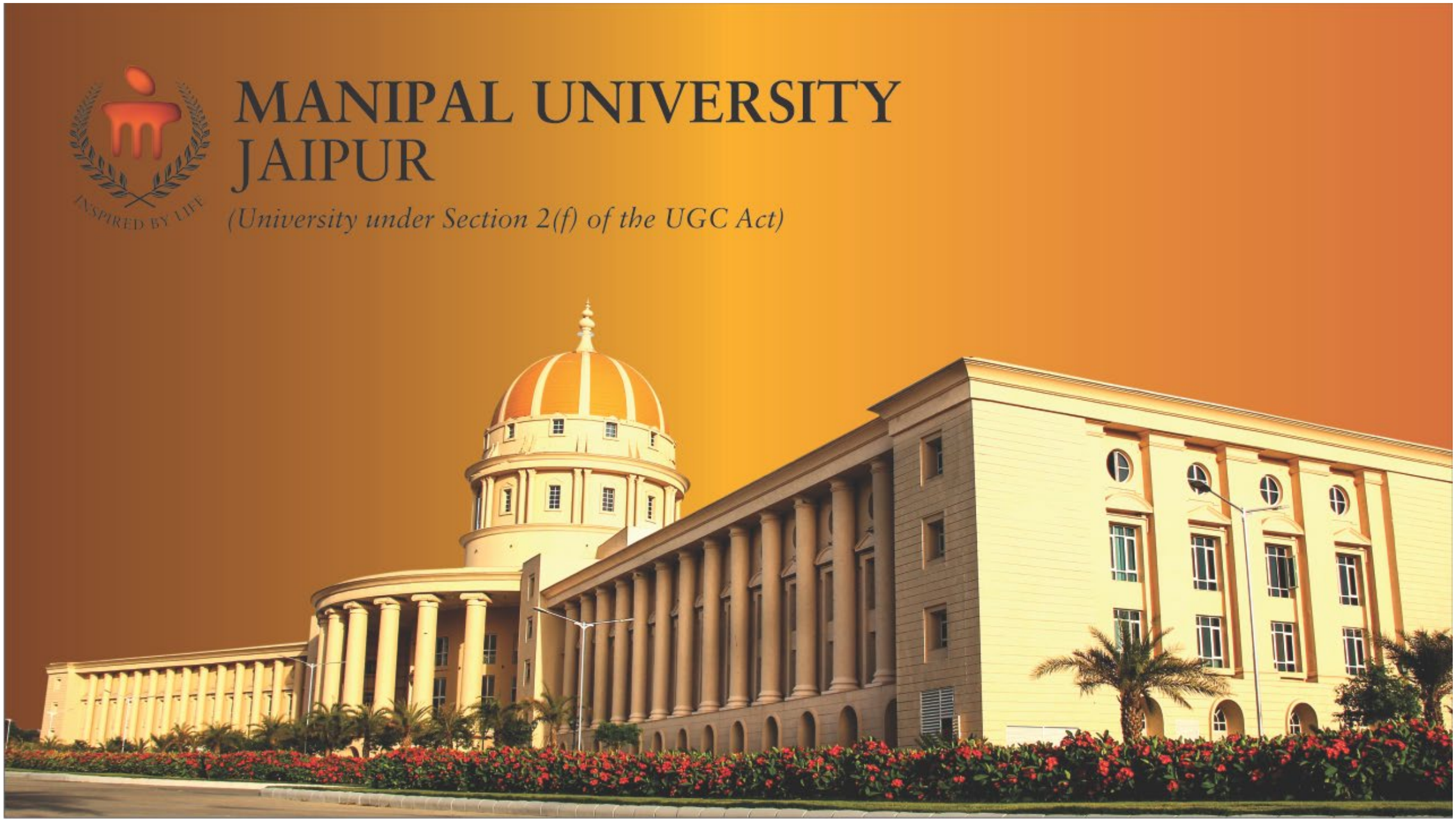
Manipal University Jaipur has a unique position as leaders in the communities and society at large. When it publicly pledges to achieve 100% renewable energy and actively promotes this commitment beyond the campus. The actions not only reduce its carbon footprint but inspire others to follow suit. In a world grappling with the urgent need for sustainable energy solutions, Manipal University Jaipur is setting a shining example of what can be achieved through determination, innovation, and a shared commitment to a greener future. The commitment to 100% renewable energy is a bold declaration that Manipal University Jaipur is embracing. Beyond reducing its own carbon footprint, it recognizes the need to catalyze broader change in society. Transitioning to renewable energy sources significantly reduces carbon emissions, contributing to local and global efforts to combat climate change. The shift to renewable energy often leads to the creation of green jobs and stimulates economic growth in the region. By diversifying energy sources and relying on renewables, communities become less vulnerable to energy supply disruptions. Clean energy sources lead to improved air quality, reducing health risks associated with pollution. The Manipal University Jaipur's commitment to renewable energy provides educational opportunities for community members, empowering them with knowledge and skills related to sustainability and renewable energy technologies.

Manipal University Jaipur is increasingly sourcing its energy from renewable sources, on-campus solar panels and partnerships with local renewable energy providers. Manipal University Jaipur is actively engaging with the local communities and municipalities to promote renewable energy adoption. Manipal University Jaipur is hosting informational sessions, workshops, and seminars to educate the public on the benefits of clean energy sources and how to transition to them. Manipal University Jaipur is actively advocating for supportive renewable energy policies at the local, state, and national levels. Manipal University Jaipur recognizes that policy changes are essential to creating an environment where renewable energy adoption can thrive. Manipal University Jaipur is at the forefront of renewable energy research and innovation. It is developing cutting-edge technologies and solutions that not only benefit the campus but can be shared with the broader public to accelerate the transition to renewable energy.

MANIPAL UNIVERSITY
JAIPUR

7 AFFORDABLE AND CLEAN ENERGY

GRIHA Exemplary Performance Awards



Name of Project - **Manipal University Jaipur**
Project Location - **Jaipur, Rajasthan-303007**

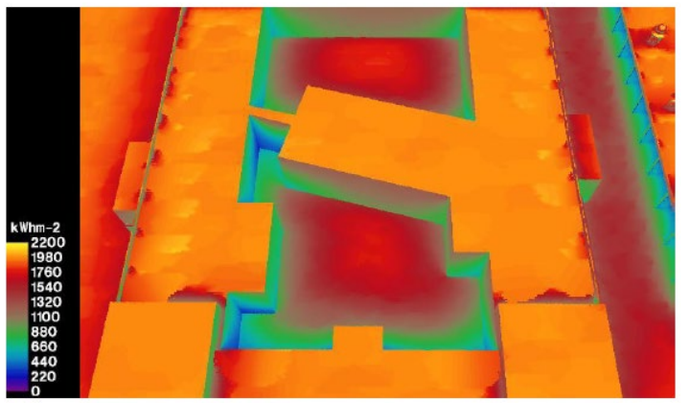
INDEX

Project brief

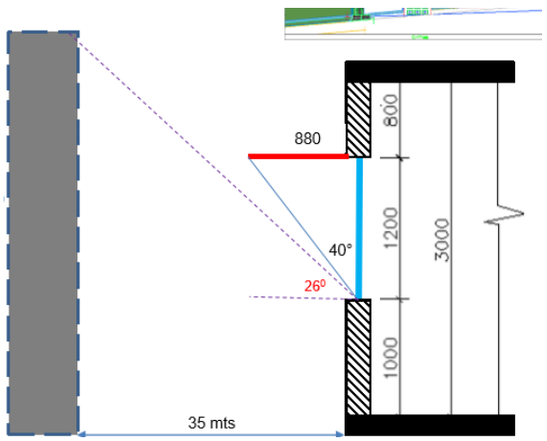
- Project name – Manipal University Jaipur
- GRIHA project code – 11GR0065 & 15GR0063
- Location – Jaipur, Rajansthan-303007
- Site area – 6,23,216 m²
- Built up area – 215395 m²
- No. of storey – 3 Nos. of G+3 and 11 Nos. of G+5
- No. of building blocks – 2 Academic, 1 administrative & 11 Hostel blocks.
- Typology – Institution

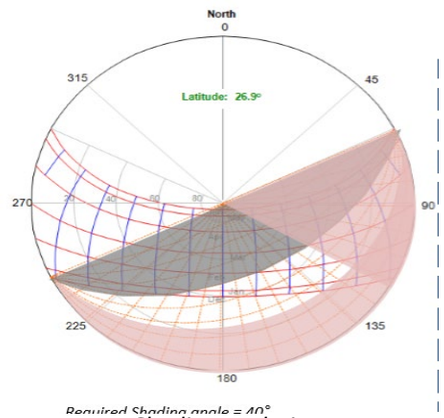
PASSIVE DESIGN FEATURES

The Manipal University campus deploys many passive strategies that aid in reducing the overall load on artificial lighting and mechanical cooling/ventilation. This includes form optimization, optimization of openings to improve daylight and ventilation, and reduction of solar gains through shading.

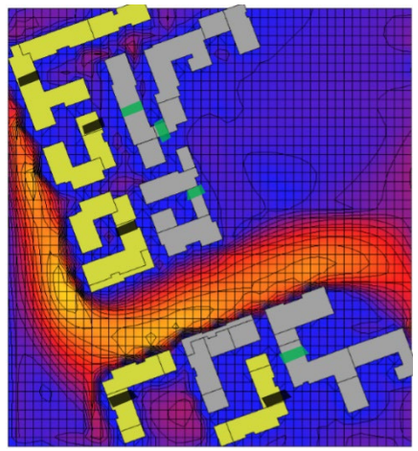


Irradiation mapping (source: Ecotect)





Shading analysis



Wind flow analysis (source: Ecotect)

NCREASED SITE VEGETATION TO REDUCE UHIE: Irradiation mapping was used to arrive at areas that require vegetation & shading in order to minimize UHIE. The intent was to ensure that spaces between buildings had enough shade so that occupants can walk. In open areas where building volumes alone were not enough to provide shading .tree canopy covers were recommended to shade.

SOLAR CONTROL & THERMAL MASS: In university blocks, large courtyards are broken into two small ones to improve the self-shading. With the maximum amount of thermal mass on external walls and courtyard facing walls both external and internal walls are well buffered with corridors & jaalis.
Jaalis were designed based on daylight simulation to ensure that opening percentage brought in the necessary amount of daylight within the space while providing adequate shading.

Hostel block buildings are clustered which leads to several small courtyards, these building have varied heights results into self-shading. Thus reducing direct gain. Shading provided for windows are different for different orientations to court direct sunlight entering the buildings. The width of the streets connecting the buildings are adequately provided such that the intense solar radiation during late mornings and early afternoons is avoided

SHADING ANALYSIS: Shading analysis was done as per sun path, after a conscious study, straight projection from the wall surface was used as a shading device for hostel buildings. and Jaali's were used as shading for University buildings. The shading sizes are optimized to provide thermal control and in effect shade space from March to October for a time of 10 am to 3 pm

WIND ASSISTED COOLING: The primary wind direction in Jaipur is West to east. At University blocks, large lobby openings are on the east and west which allows free flow of wind through courtyards around the buildings. The courtyard areas have been planted with lush green cover, this vegetation is predicted to act as cool air pond helping in the natural cooling of the building

PASSIVE DESIGN FEATURES TO REDUCE LOAD ON ARTIFICIAL COOLING AND LIGHTING:

Approach:

Several passive measures have been implemented in the Academic block, admin block and hostel phases at MUJ to optimize and reduce energy consumption. The following strategies have been adopted:

- WWR has been minimized given that Jaipur is a hot and dry climate. All windows are well shaded from 9 am to 4 pm throughout the year and high-performance glazing has been used. In cases where structural shading proved to be inadequate, jaalis have been used to cut solar radiation.
- Thermal mass and good insulation have been used to maximize thermal lag in the building. The building has a high-performance envelope which cuts the cooling load of the building with optimized shading, glazing, and insulation of walls and roof.
- Daylighting is used to a great extent, thereby reducing the artificial lighting related internal load.
- Furthermore, the Academic block has been designed to be cooled via natural ventilation and with Air-conditioning, i.e. mixed-mode. Windows are also split into higher and lower sections that can be opened independently in order to assist both stack and cross ventilation. The building has been designed to run on natural ventilation for 4 to 5 months a year from mid-October to mid-March. The opening proportion and operability of the panes have been studied and optimized with the help of thermal simulations.

Projections & results:

The following are the adopted U-factor for various building elements in the Academic and admin blocks. They all lie below the maximum prescribed GRIHA limit:

Building element	U factor (W/sq.m/K)	
Glazing	1.04-1.77	(SHGC – 0.25)
External walls	0.422	
Roof	0.39	

The total window to glass ration is less than 25% as per design. The WWR for various is well under the maximum allowable limit. The window to wall ratio for various blocks is as follows:

Space/area	Window to wall ratio (%)
Academic/admin blocks_Phase 1a,b & c	23%
MUJ_hostel (phase 1)	8.52%
MUJ_hostel (phase 2)	9.76%
MUJ_hostel (phase 3)	11.17%

The daylight levels as assessed by calculating the percentage of day lit area of the total living area. The percentages of various day lit spaces are as follows:

Space/area	Total % of day lit area
Academic/admin blocks_Phase 1a,b	32%
Academic/admin blocks_Phase 1c	27.83%
MUJ_hostel (phase 1)	64.60%
MUJ_hostel (phase 2)	73.67%
MUJ_hostel (phase 3)	86.93%

The percentage reduction in energy consumption as compared to the prescribed benchmark in GRIHA is listed below.

Space/area	% reduction in energy consumption
Academic/admin blocks_Phase 1a,b & c	56.2%
MUJ_hostel (phase 1,2 & 3)	48.3%

ENERGY MANAGEMENT

ENERGY MANAGEMENT AT MANIPAL UNIVERSITY JAIPUR

MUJ follows a proactive, organized and systematic management of energy use in all of the campus and hostel buildings to satisfy both environmental and economic requirements.

Protocols followed in MUJ for an efficient energy management:

- All the buildings in MUJ are equipped with energy meters so that building specific energy usage can be monitored on regular basis.
- All the commissioned systems in MUJ undergo periodic checks to ensure that they are working as per the design.
- Issues with regard to equipment/systems operation and efficiency losses are immediately reported to concern parties and they are rectified
- Periodic energy audits are carried out for all the buildings in MUJ

Key implementations at MUJ to reduce energy demand and increase energy conservation:

- The building fenestration optimization was done to reduce the fabric gains of the space by using energy efficient glazing along with optimized shading to reduce solar gains
- All external wall of University buildings use thermally insulated blocks & Hostel walls have air cavity to accommodate insulation
- The HVAC of hostels and university are designed as per the compliance of ASHRAE, NBC & ECBC
- LED's are used for the majority of internal lightings
- LED light fixtures are used for all external street lighting, and these are equipped with astronomical timers
- Solar based water heaters are equipped in hostels to meet the hot water demand.
- All the chillers have an inbuilt timer based controls to maintain operation timings

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OPTIMISING ENERGY CONSUMPTION IN BUILDINGS

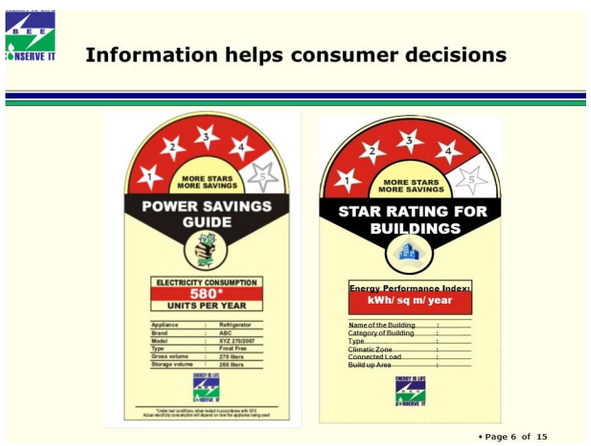
Building energy efficiency is strongly linked to the operations and control systems, together with the integrated performance of passive and active systems. Energy consumption at MUJ is regulated by following both passive and active methodologies. multiple analysis were run for all the buildings to determine their energy usage, indoor comfort levels, daylight allowance etc. based on the results from analysis systems are designed..

Optimisation through efficient HVAC:

- All the mechanical equipment used for MUJ hostels and University building are compliant with ECBC
- chillers installed in hostel blocks is COP-3.23 in cooling mode and COP-2.64 in heating mode
- chiller installed in University buildings has COP-3.11, 3.02 in cooling mode and COP-3.08 in heating mode
- All chiller has inbuilt timer controls to operate only in specified durations
- R- value of the pipe insulation of cooling systems is 1.5(m2-k/w)
- Thermal conductivity of duct insulation used is .040w/m k

Optimization through Equipment:

- The Motor efficiency of pumps installed in MUJ is 81%
- Automatic capacitors are added in the circuit and power factor is maintained at ≥ 0.95. this is monitored on day to day basis
- Adequate Cable length of 157mtrs is used and power losses are maintained less than 1%
- Solar hot water systems with a system efficiency of 40.7% are installed in Hostel blocks
- BEE Energy star rated equipment's are used in the project

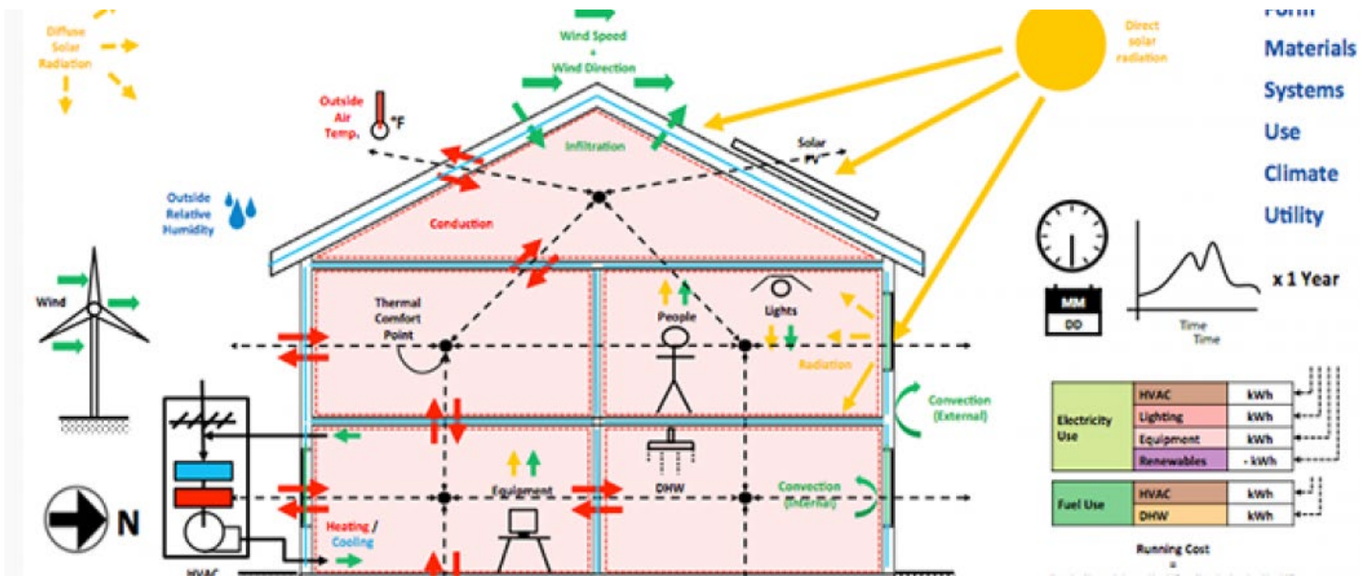


Optimization through efficient Lighting:

- LED'S are used for all the external street lightings which have a power requirement of 90w and luminous efficacy of 110lum/w
- LPD achieved for the project is not more than 0.35w /sqm
- All external pole and garden lightings also has LED source with a power requirement of 36w, these lights have a luminous efficacy of 128lum/w
- All street lights in MUJ are controlled with astronomical timers

Optimization through Building Envelope:

- U-factor Glazed units in MUJ buildings are in the rage of 1.04 W/m2K to 1.77 W/m2K . & SHGC of the view pane is 0.24
- All walls in MUJ campus buildings has a u-factor of 0.422 W/m2ºC
- All walls in MUJ Hostel buildings has a u-factor of 0.62 W/m2ºC
- U factor of roof in MUJ University buildings is 0.391w/m2ºC
- U factor of roof in MUJ hostels is 0.391w/m2ºC



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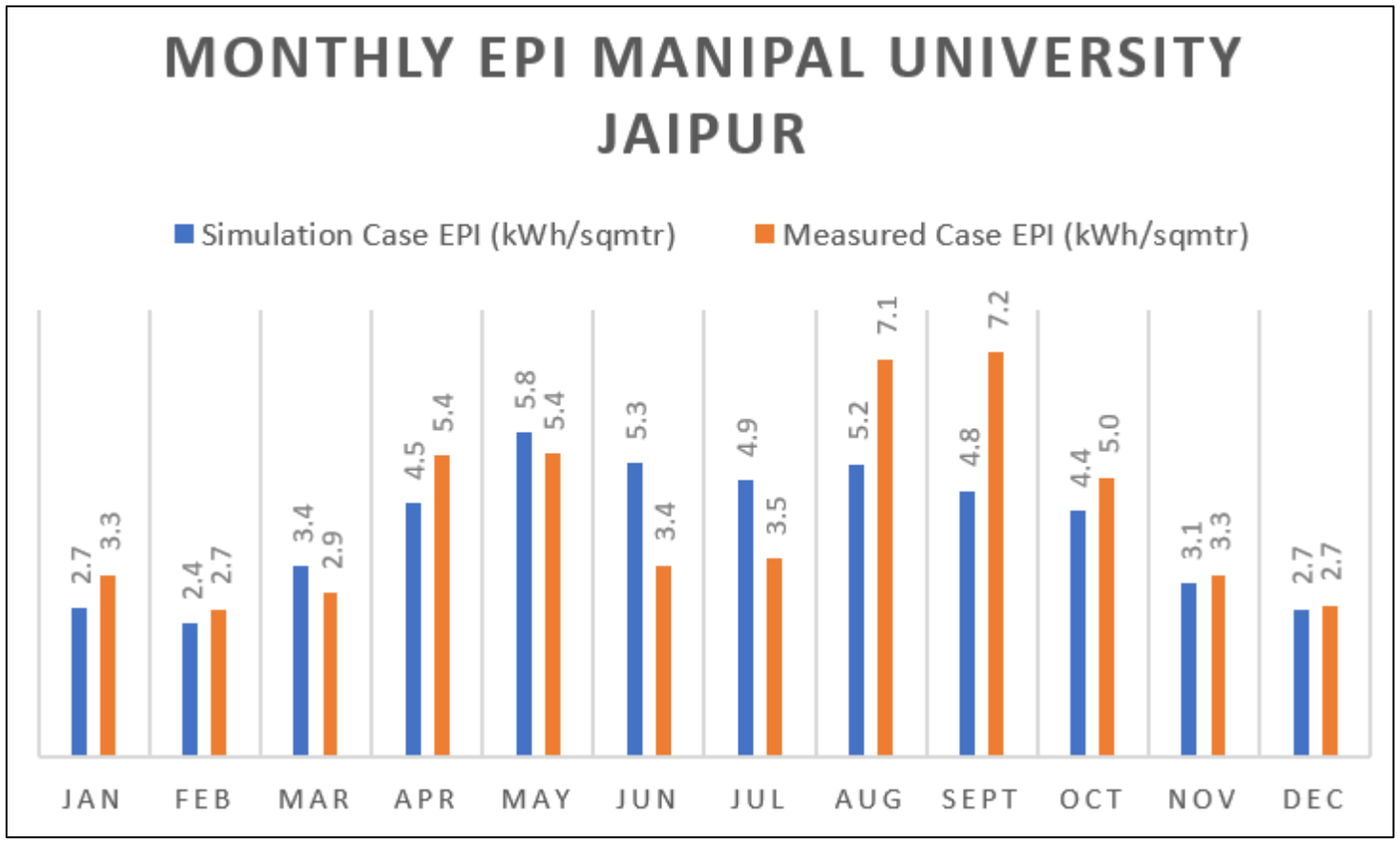
Projections:

- Based on the simulation reports documented for GRIHA, Total energy consumption of MUJ Hostels & MUJ university buildings are as follows
  - MUJ UNIVERSITY=16,20,606 kWh/year
  - MUJ HOSTELS = 56,93,467 kWh/year
- EPI achieved for whole project is 49.16kWh/sqm/year
- Total energy savings documented is 50.84% for whole project

Results:

- From the meter readings energy consumption of MUJ Hostels and university buildings are as follows
  - MUJ UNIVERSITY=12,99,920 kWh/year
  - MUJ HOSTELS = 64,38,740 kWh/year
- EPI achieved for whole project is 52.0 kWh/sqm/year
- Total savings achieved when compared with benchmark savings is 48% for whole project



INTEGRATED WATER MANAGEMENT AT MANIPAL UNIVERSITY

SUSTAINABLE INTEGRATED WATER MANAGEMENT AT MANIPAL

UNIVERSITY JAIPUR

Integrated Water management strategies that are implemented & designed for Manipal University Jaipur mainly focus on triple bottom line benefits i.e social, economic and environmental benefits. This creates a flexible, resilient water infrastructure which helps us progress towards NET ZERO/ WATER NEUTRALITY.

Some of the key highlights of sustainable water management at MUJ:

- Potable water use reduction by using water efficient fixtures
- Recycling 100% of waste water generated on site.
- Use of treated water for non-potable water requirement
- Reduction in landscape water use by choosing right species of plants which are regional and adaptable to location conditions
- Use of Highly efficient Irrigation equipment for landscape needs
- A well-developed stormwater management infrastructure to capture and use rainwater

WATER USE REDUCTION WITH WATER EFFICIENT FIXTURES:

Approach:

Manipal University Jaipur (Hostels & University blocks) has dual plumbing systems for all its buildings, this helps in efficiently separating the potable water from reclaimed water for building use.

- To reduce the water usage, all the building toilets in MUJ are equipped with automatic, low flow fixtures and low flush fixtures. These fixtures when compared with conventional fixtures, can save a significant amount of water.
- 100% wastewater is treated on site and used for flushing purposes within the building .

FIXTURE TYPE	CONVENTIONAL FLOW/FLUSH FIXTURE(base case) FLOW RATE LPF/LPM	FIXTURE FLOW RATES INSTALLED IN MUJ (design case) LPF/LPM
WC Flush	≤ 6 LPF	3 & ≤6 LPF
Sensor Urinals	≤ 3.8 LPF	≤ 0.5 LPF
Restroom Faucets	≤ 9.4 LPM	≤ 2.75 LPM
Pillar cock	≤ 9.4 LPM	≤ 2.75 LPM
Health faucet	≤ 9.4 LPM	≤ 6.4 LPM
Kitchen Faucet	≤ 9.4 LPM	≤ 7.5 LPM

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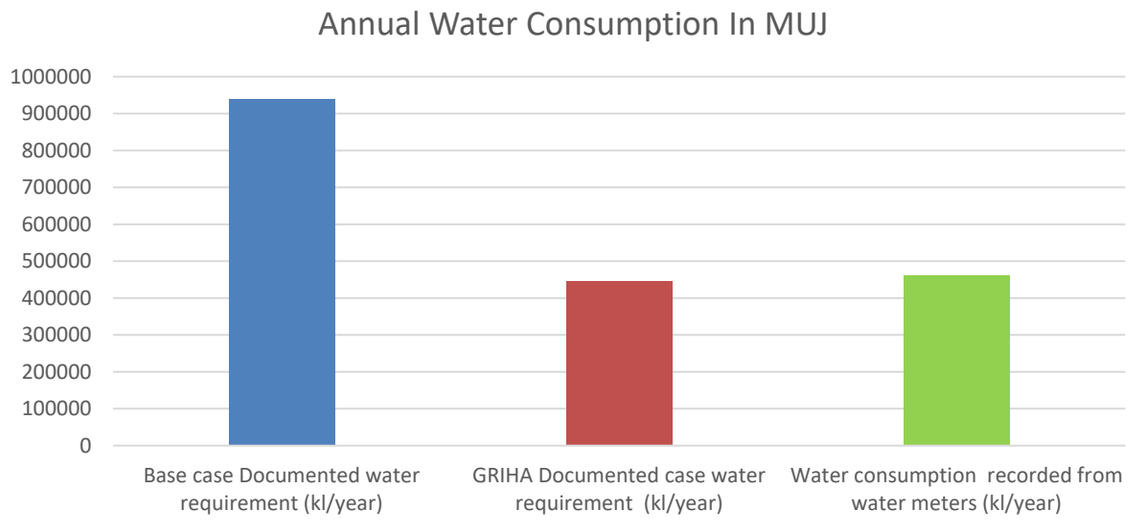
Projections:

- Based on calculations, performed for GRIHA, MUJ will require **14,988.79 Kl/year** of water annually for university blocks. & **4,29,365.9 Kl/year** for hostel blocks
- Total water consumption documented & predicted is **4,44,353.75 Kl/year**
- Based on our design case implementations which were documented for GRIHA rating, we have anticipated a minimum of 40% water saving through efficient fixtures.

Results:

- As per the recorded data from water meters, University blocks currently use **20,412.10 Kl/year** & Hostel blocks use **4,40,500 Kl/year.**
- Total water consumption of the project is about **4,60,912 Kl/year**
- The water usage in performance case is a little high than design case is due to the usage patterns of occupants



POTABLE WATER USE REDUCTION FOR LANDSCAPE

Manipal University Jaipur has a green cover of about 66065sqm, this accounts almost 53% of total site area. Since the project location is declared as the notified area by Central Ground Water Authority, MUJ strictly implemented plans to manage water efficiently and recharge groundwater. The whole system has been designed to be a zero discharge stormwater and wastewater from the site.

Approach:

- Native and adaptive plant species with larger canopy cover are chosen & lawn areas are reduced wherever possible in landscape design.
- Water efficient irrigation systems are used for landscaping which comprises of micro drips and highly efficient sprinklers. The irrigation efficiency of the systems used for landscape watering is less than 0.75
- Wastewater is treated to termitary standards and used for landscaping need along with collected rainwater

Projections & Results:

- Estimated water requirement for landscape needs in MUJ through calculations is 123026 kl annually.
- When compared to base case design which was documented for GRIHA, the project could achieve nearly 50.26% water savings by using efficient irrigation equipment and native and adaptive species in the landscape.
- Roughly 72.3% of the annual landscape water demand after savings is met by Treated waste water and collected rain water together.

GRIHA Exemplary Performance Awards

WASTE WATER TREATMENT

Manipal University Jaipur has zero discharge waste water policy. Hence 100% of the wastewater generated on site will be treated to tertiary standards and reused within the campus for various purposes like Flushing, cooling tower makeup, Horticulture etc.

Approach:

- MBR Type STP with a capacity of 600kld is commissioned at MUJ university campus considering the future developments & excess wastewater from hostels
- A standalone 350kld STP is commissioned to serve only the Hostel blocks, excess wastewater is sent to University STP.
- Wastewater treated on site will have projected water quality standards meeting CPCB norms

Projections & Results:

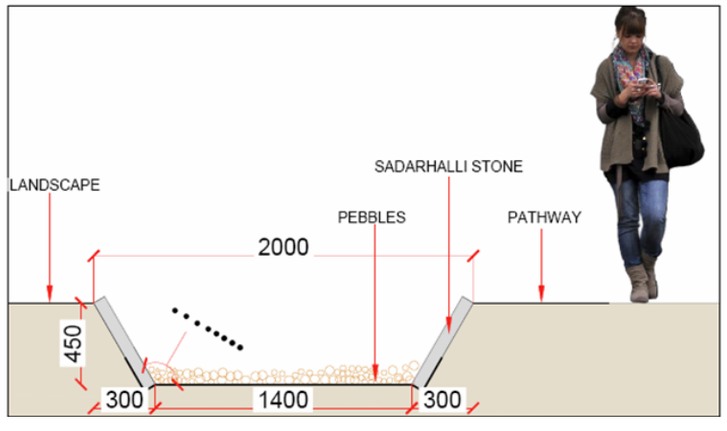
- Annually 98897.1 kl of treated water is available for building and landscape uses
- 30339 kl/year i.e. 30.6% of total available treated wastewater is used for non potable uses in all the buildings.
- 68558 kl/ year i.e. 69.4% of total available treated wastewater is used for landscape requirement in both hostels and university campus.

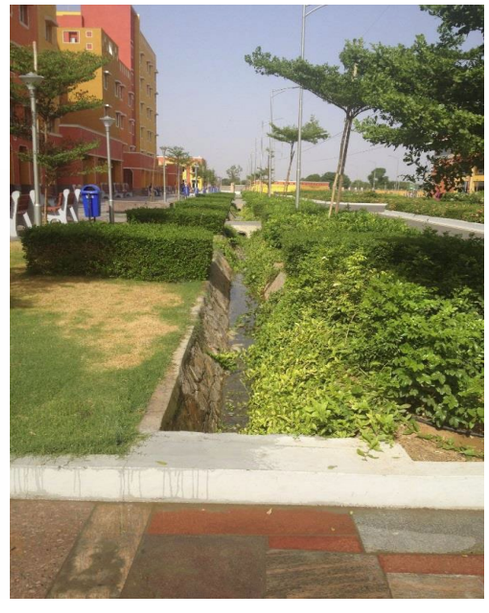
STORM WATER MANAGEMENT AND RAIN WATER REUSE

Stormwater from building rooftops will be collected in rainwater collection tanks These tanks are connected to the WTP.

Storm water from the site is collected in swales. Part of this water is diverted to a collection tank that also works as a sedimentation pit. The rest of the stormwater is diverted to 3 recharge pits located in the lowest part of the site. The collection tank is in turn connected to the WTP.

- Rainwater holding capacity at MUJ Hostel blocks 670kl & University blocks is 490kl
- Annually available rainwater at overall MUJ is 68599 kl/year in which 29.8% i.e. 20492 kl/year is used for the project requirements & 60.2% i.e. 41278.5 kl/year is recharged into the ground
- Collected rain water from roofs is treated with WTP on site and conveyed to the various buildings in Manipal University Jaipur
- Rain water from different areas on site is conveyed to ground water recharge pits through percolation swales. These swales reduce the rate of flow during conveyance and allow stormwater to percolate into the ground as it reaches the recharge pits





RENEWABLE ENERGY UTLIZATION AT MANIPAL UNIVERSITY JAIPUR

RENEWABLE ENERGY AT MANIPAL UNIVERSITY JAIPUR

Renewable energy Utilization is an important part of the design and development at Manipal University Jaipur. as part of this, solar p.v arrays are set up on the rooftops across multiple buildings in the University.

As a part of the initial design, a total of 700kWp solar power PV systems are set up on different building roof tops to serve various buildings in MUJ, in the second stage additional 150kwp is added. now the total capacity is upgraded to 1485kWp for future buildings. Total estimated future energy generation annually including the new installments is 22,84,748 kWh/year

The power generated will be the generic power that is not directed to a specific building but will be directed to the grid. Therefore the power reaching all the buildings will be a result of solar power generated and directed

From the initial solar PV installment of 700kWp, university blocks are catered 270kWp and all the hostel blocks are catered 310kWp.

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USE OF RENEWABLE ENERGY IN MANIPAL UNIVERSITY

MUJ has opted to go for solar energy systems because the potential to generate energy from solar in a region like Jaipur is high, also harnessing solar energy reduces dependence on the electric power grid, substantial energy savings are achieved by lower demand and operating charges.

Manipal University mainly focus on increasing its renewable energy generation to make the project self sufficient and progress towards net-zero & net positive in near future. As a part of this plan, Manipal university is increasing the size of the solar PV plant to 1485kwp

Approach:

Energy generated from the installed solar pv is intended to offset energy requirements of external and inter lighting, space conditioning and water heating

- Size of the solar power plant installed & serving the project in the current stage is 850kWp
- Efficient solar panels with a cell efficiency of up to 17% are used in setting up solar PV.
- An additional 625kWp will be installed and commissioned in the future.

Projections:

- It is estimated that on-site generated solar energy would offset a minimum of 30% total lighting load of both hostels and university blocks.
- At least 1% of the connected load of the project is offset by solar power generated
- Estimated total energy generated by the installed solar PV at MUJ which is documented for GRIHA rating is 10,43,689 kWh/annually

Results:

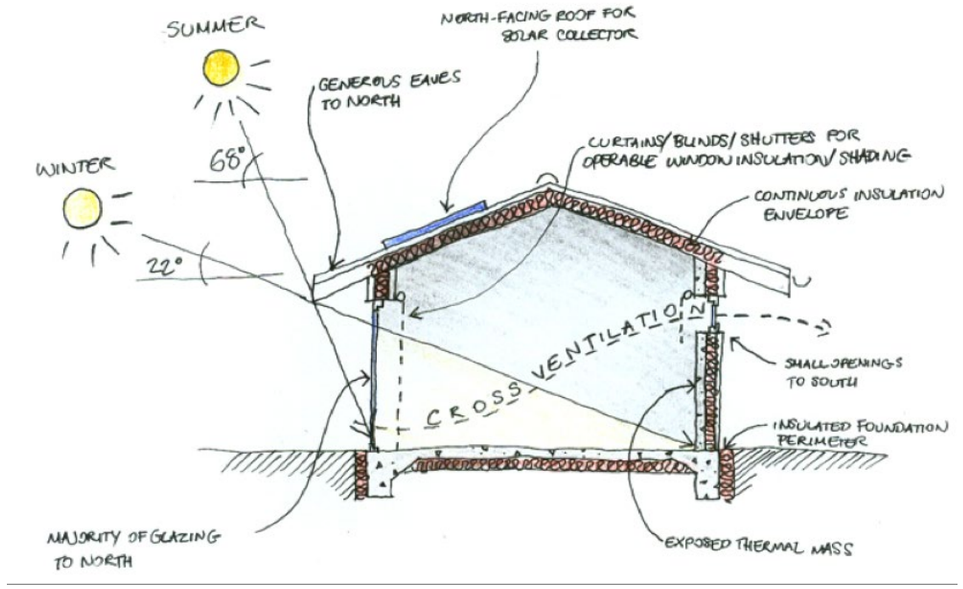
- Based on the data recorded on site, total energy generation on site is 12,86,856kwh/year
- 19.9% increase in the energy generation in the performance case when compared with the design case which was documented to GRIHA.
- 100% of the lighting energy requirement is met with energy generated from solar PV.
- 31.1 % of the connected load from lighting and space conditioning is met with installed solar PV

	Energy required for lighting (Internal) kWh/year	Energy required for space conditioning KWh/year	Total energy generated from solar in documented case	Total energy generated based on energy meter readings
MUJ hostels	7,24,279	21,29,288	**10,43,689**	**12,86,856**
MUJ university blocks	4,06,775	8,74,884		
Total	11,31,054	3004172		
Total connected load (lighting + space conditioning)	41,35,226			

SUMMARY

PASSIVE ARCHITECTURE DESIGN

- Wind flow analysis to optimize the position and size of openings.
- Shading studies for the optimization of glazing. This included the analysis of self shading due to the location of the blocks, shading due to structural elements and identification of any additional shading that maybe required.
- Irradiation mapping for solar PV placement.
- Thermal analysis for form studies based on solar gains due to position and orientation.



ENERGY MANAGEMENT

ENERGY REDUCTION STRATEGIES:

- Building walls and roofs are well insulated to cut down heat gains through the envelope
- Use of energy efficient HVAC systems for all the buildings. All chillers in MUJ has a minimum COP 3 in cooling mode.
- Timer based controls are used for all chillers & external street lightings to operate in specified timings
- Improve operations and maintenance practices by regularly checking and maintaining equipment to ensure it's functioning efficiently.
- maximized daylight areas in the buildings to reduce the use of artificial lighting during daytime operation
- All the buildings are equipped with energy meters to measure real-time data on a regular basis
- LPD achieved for the buildings is 0.35w/sqm

REDUCTION OF ENERGY CONSUMPTION:

- GRIHA documented energy consumption reduction: 50.84%
- Energy consumption reduction based on meter readings: 48% **(savings achieved in performance case is less because of occupant usage patterns)**

BENCHMARK EPI: 100 KWh/ m^2/year
PROPOSED EPI: 49.16KWh/ m^2/year
ACHEIVED EPI :52.0KWh/ m^2/year

GRIHA Exemplary Performance Awards

INTEGRATED WATER MANAGEMENT

WATER MANAGEMENT : To develop a sustainable water management structure, MUJ has mainly focused on water demand reduction, both for buildings and Landscapes. and offset water demand with treated waste water & collected rainwater for potable and non-potable use.

- Dual plumbing system is installed in all the buildings
- Use of water efficient flush and fixtures in all the buildings
- Native and adaptive plant species are used in landscaping as they require minimum to no water to thrive
- Highly efficient irrigation systems like micro drip and sprinklers are used for landscape irrigation
- 100% wastewater generated on site is treated with two STP's installed and treated water is reused for building & landscape water requirement.
- Rainwater is collected from roofs and site, the collected water is treated with WTP and used back for buildings and Landscape
- Rainwater recharge pits are constructed to recharge the local aquifer

DEMAND SIDE REDUCTION IN BUILDINGS:

- In the GRIHA documented case MUJ as whole project could achieve 52.7% water savings when compared with base case requirement.
  - MUJ HOSTELS : 52.54%
  - MUJ UNIVERSITY BLOCKS : 47.69%
- Water savings achieved based on the water use data recorded from water meters is 49%
  - MUJ HOSTELS : 51.3%
  - MUJ UNIVERISITY BLOCKS : 41%

SUPPLY SIDE MANAGEMENT:

- In order to reduce the demand on potable water MUJ uses treated wastewater for all its non-potable uses like flushing and landscaping
- Rainwater from roofs is treated on site and used for potable water uses
- Regular water audits are conducted and regular data monitoring is performed in any issues or leaks are identified in the water supply structure they are fixed immediately

RENEWABLE ENERGY UTLIZATION- SOLAR PV

- Base on the calculations performed by the energy model it is estimated that the total energy consumption of internal lighting and space conditioning for whole MUJ(University buildings & hostels) is **41,35,226kWh/year.**
- Renewable Energy generation on site at the current stage with an **850kWp** system is **12,86,854kWh/year**
- Renewable energy system installed in MUJ will offset **31.1%** of the energy required for internal lighting and space conditioning
- Operation capacity of solar P.V setup at the current stage is **850kWp** however additional **625kWp** is being installed and will be commissioned shortly

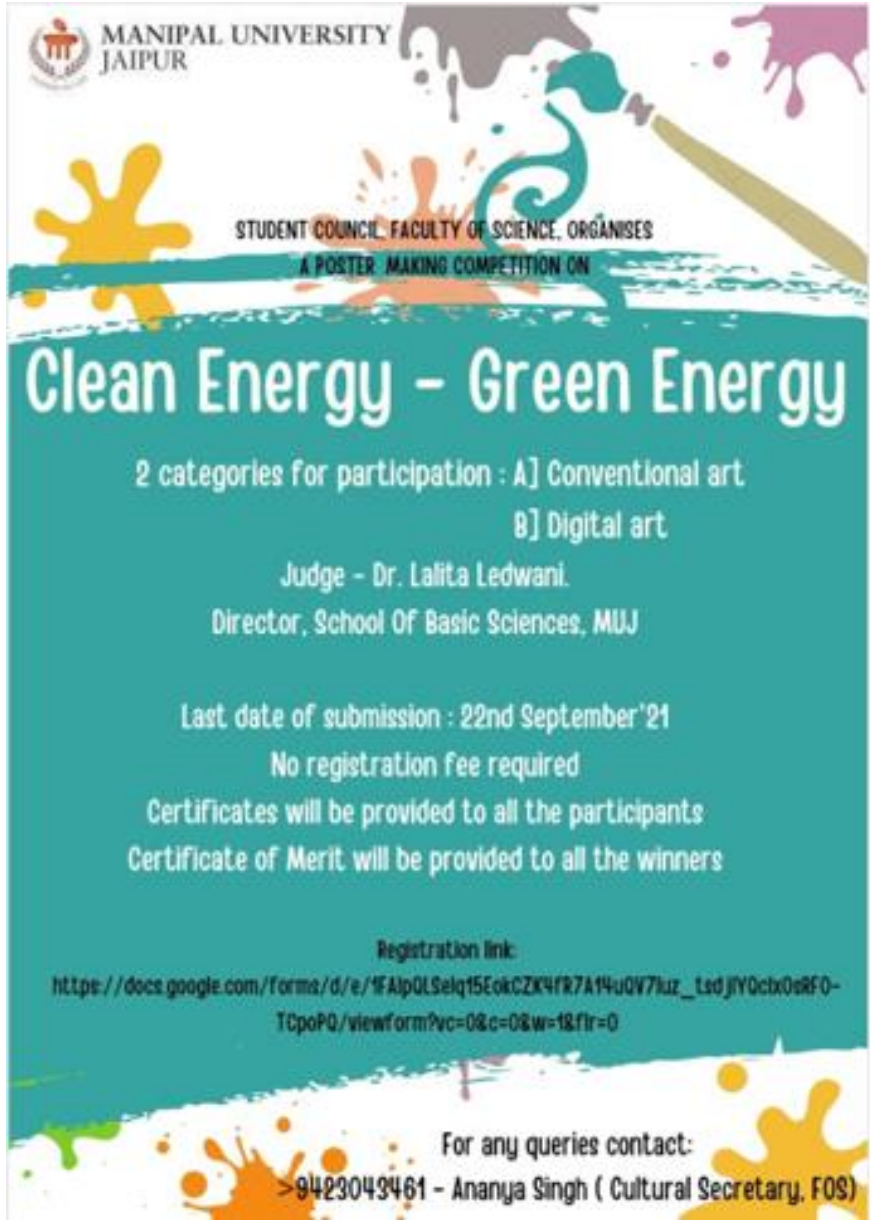
Contact details

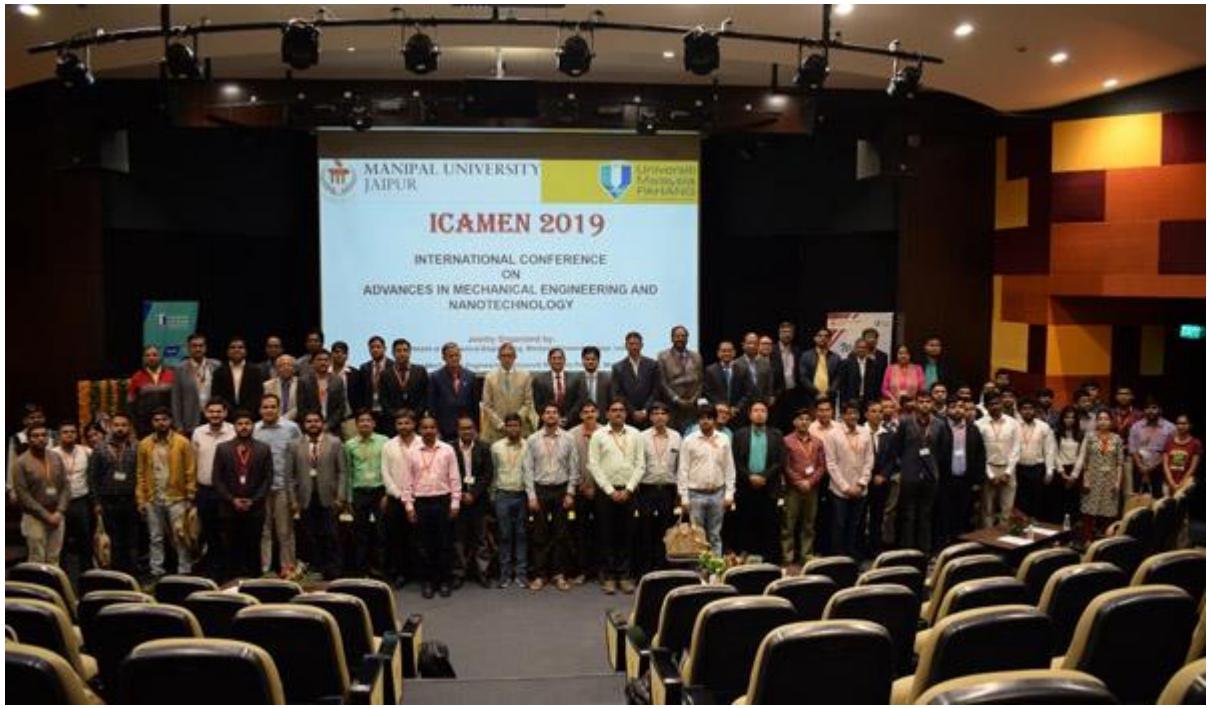
- Contact person –
  - Name – Dr. Vandana Suhag
  - Designation – Registrar
  - Organization – Manipal University Jaipur
  - Mobile no. – 8003599903
  - Email id – registrar@jaipur.manipal.edu
- Nominees (max. two attendees) for the Award Evening –

Sr. No.	Name	Designation	Organization	Mobile No.	Email id
1	Dr. Vandana Suhag	Registrar	Manipal University Jaipur	8003599903	registrar@jaipur.manipal.edu
2	Col. Virender Yadav	CAO	Manipal University Jaipur	8003599902	virender.yadav@manipalglobal.com

7 AFFORDABLE AND CLEAN ENERGY

Green Building Ratings

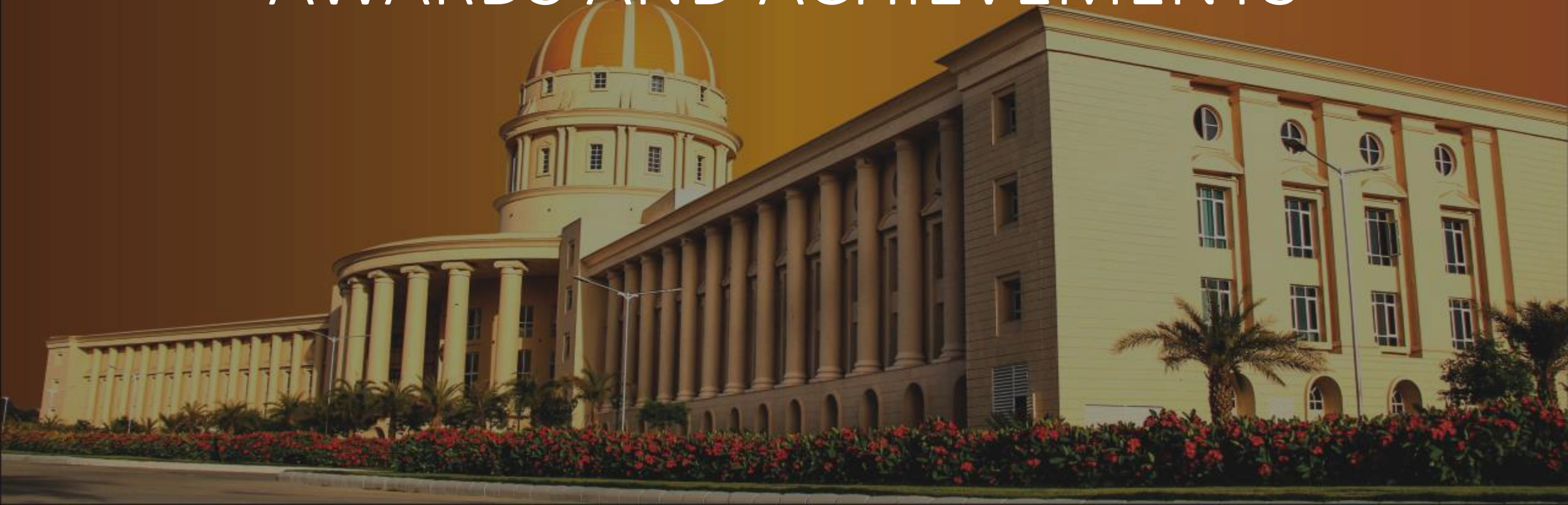

MANIPAL UNIVERSITY
JAIPUR
STUDENT COUNCIL, FACULTY OF SCIENCE, ORGANISES
A POSTER MAKING COMPETITION ON
Clean Energy - Green Energy
2 categories for participation : A] Conventional art
B] Digital art
Judge - Dr. Lalita Ledwani.
Director, School Of Basic Sciences, MUJ
Last date of submission : 22nd September'21
No registration fee required
Certificates will be provided to all the participants
Certificate of Merit will be provided to all the winners
Registration link:
https://docs.google.com/forms/d/e/1FAIpQLSeIq15EokCZK4fR7A14u0V7luz_tsdJIYQctx0eRF0-TCpoPQ/viewform?vc=0&c=0&w=1&flr=0
For any queries contact:
>9423043461 - Ananya Singh (Cultural Secretary, FOS)


MANIPAL UNIVERSITY
JAIPUR
ICAMEN 2019
INTERNATIONAL CONFERENCE
ON
ADVANCES IN MECHANICAL ENGINEERING AND
NANOTECHNOLOGY


to Promote Innovation &
Research in Energy Efficiency
11th – 13th November, 2018 | New Delhi
#InnovateToINSPIRE
#InnovateToINSPIRE
EESL
PAY TO THE
WINNER
In category of
IMPROVED GRID MANAGEMENT SYSTEM
Date
11-11-2018
₹ 5,00,000.00
Amount
FIVE LAKH RUPEES ONLY
Signature
R. K. Singh

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

AWARDS AND ACHIEVEMENTS



MANIPAL UNIVERSITY JAIPUR

स्वच्छ भारत
एक कदम स्वच्छता की ओर

MUJ: Awards & Achievements

GRIHA AWARD

First University in the country to be awarded GRIHA award for integrated Water Management.

LEED INDIA PLATINUM Award .

Manipal University has been conferred with this award being the first campus in the country to do so for Green Building . Based on review done by IGBC on the credits submitted by the university, which were evaluated against the rating system for certifying Green Buildings.

GRIHA FIVE STAR RATING

The first University in the country to receive this award for Energy Conservation and Environment Friendly Design.

MANIPAL UNIVERSITY
JAIPUR

स्वच्छ भारत
एक कदम स्वच्छता की ओर

MUJ: Awards & Achievements

'Swachhta' Ranking
Award 2017 by **Ministry of HRD**

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

Recognitions and Awards (Regulators and Local Community)

Ranked 2nd all over India in Swachhta Ranking 2017

Ranked 4th all over India in Swachhta Ranking 2018

Ranked 4th all over India in Swachhta Ranking 2019

IGBC Performance Challenge 2020 for Green Built environment- Excellence Award'

Outlook-ICARE Ranking 2020
THE BEST PROFESSION COLLEGES

3.5 Star IIC Rating of MUJ for Academic Year 2019-20

MUJ ARIIA Rankings 2020

MANIPAL UNIVERSITY
JAIPUR

7 AFFORDABLE AND CLEAN ENERGY

Manipal University Jaipur is Empowering Local Industry with Energy Efficiency and Clean Energy Services

Manipal University Jaipur is stepping up to bridge the gap between knowledge and implementation. Manipal University Jaipur is extending its reach to directly serve local industries, providing essential services aimed at improving energy efficiency and promoting clean energy solutions. Energy efficiency assessments often lead to significant cost savings for industries, improving the bottom line. By adopting sustainable practices and renewable energy sources, industries can gain a competitive advantage in the market. Industries reduce their environmental footprint, showcasing their commitment to corporate social responsibility. Energy-efficient practices and clean energy adoption contribute to long-term sustainability and resilience for local businesses. Industries gain access to the research capabilities and knowledge base of Manipal University Jaipur, which can drive innovation and continuous improvement.

By leveraging Manipal University Jaipur's expertise and resources, it is forming partnerships with local industries to facilitate a smoother transition to sustainable energy practices. One of the primary services Manipal University Jaipur offers to local industries is energy efficiency assessments. These assessments involve in-depth evaluations of a company's energy consumption patterns, equipment, and processes. Manipal University Jaipur uses its research capabilities to identify areas where energy efficiency improvements can be made. This data-driven approach allows industries to make informed decisions about energy-saving measures. Manipal University Jaipur organizes workshops, seminars, and training sessions tailored to the needs of local industries. These sessions cover a wide range of topics, including energy-efficient technologies, sustainable practices, and renewable energy adoption. Through these educational initiatives, industries gain practical knowledge and skills to implement energy-saving measures. Manipal University Jaipur collaborates with local industries to explore and develop renewable energy options suitable for its specific needs. This research not only benefits the industries involved but also contributes to the advancement of clean energy technologies on a broader scale. Manipal University Jaipur provides guidance and insights into energy-related policies and regulations. It helps industries navigate the complex landscape of incentives, rebates, and compliance requirements related to energy efficiency and clean energy adoption.

Through energy efficiency assessments, workshops, research collaborations, and more, they are empowering businesses to become more sustainable and environmentally responsible. This partnership between academia and industry not only benefits individual companies but also contributes to the broader goal of reducing carbon emissions and mitigating climate change.

MANIPAL UNIVERSITY
JAIPUR

FACULTY OF SCIENCES

SCHOOL OF BASIC SCIENCES

DEPARTMENT OF CHEMISTRY

Expert Lecture

Activities through MoU

December 29, 2021

The Department of Chemistry, School of Basic Sciences, Manipal University Jaipur, organized an industry expert lecture on 29th December 2021. The lecture was conducted in the MS Teams platform from 02.30 PM to 4.00 PM. The lecture had participants from all walks of life. In total, 22 participants from different program of MUJ attended the lecture.

The lecture was hosted by **Dr. Praveen Kumar Surolia**, Associate Professor, and Dr. Mainak Ganguly, Assistant Professor, Department of Chemistry, MUJ. **Dr. Rahul Shrivastava,** HoD, Department of Chemistry, MUJ, gave his introductory speech about the department highlighting it's activities. The invited talk was given by **Dr. T. Senthil,** Sr. Scientist, Central Institute of Petrochemicals Engineering & Technology (CIPET), Jaipur. His talk was on "Nanomaterial for sustainable energy and environment. **Dr. Maniak Ganduly**, Assistant Professor, Department of Chemistry, MUJ gave the Vote of Thanks and concluded the event.

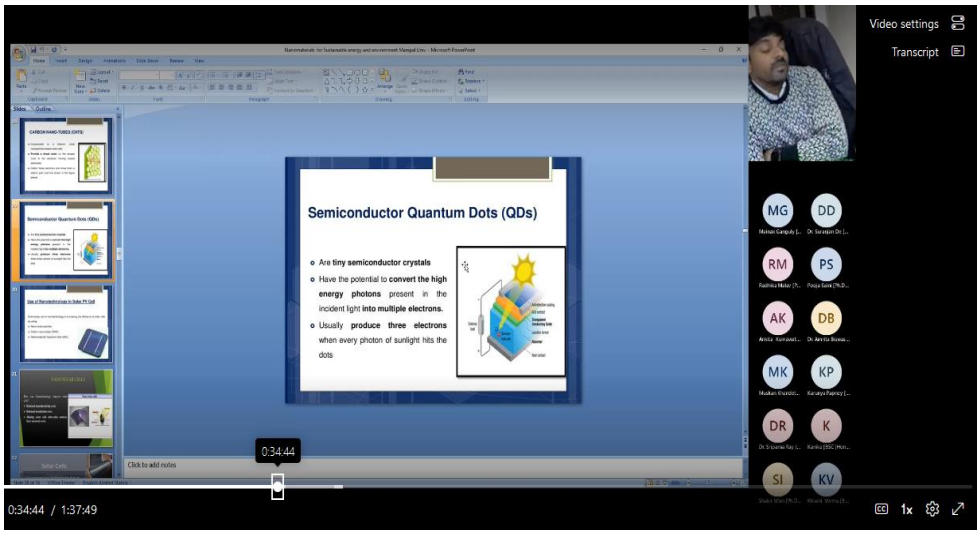
Objective of the Event

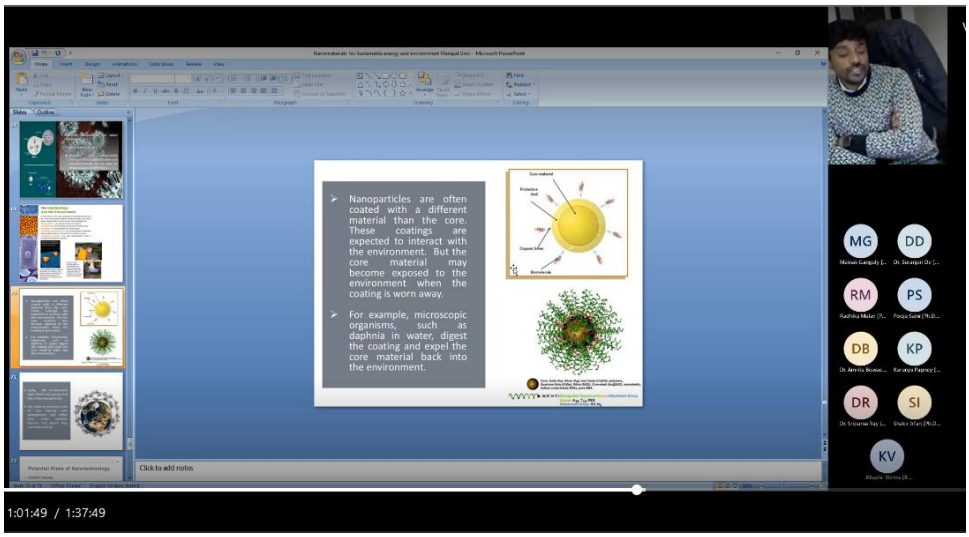
- Importance of nanomaterials and its necessity in daily life
- intends to nurture the knowledge of students about the use of nanomaterial for sustainable energy and environment.

Beneficiaries of the Event: Graduate and post graduate students

Details of the Guests:

S. No.	Name of Speaker	Organization	Designation	Title	Duration of Talk delivered
1	Dr T. Senthil	Central Institute of Petrochemicals Engineering & Technology (CIPET)	Senior Research Scientist	Nanomaterial for sustainable energy and environment	90 minutes





Invited lecturer of Dr. T. Senthil, Central Institute of Petrochemicals Engineering & Technology (CIPET), Jaipur

Brochure or creative of the event:

Attendance sheet

S.no.	Name of the Participant
1	Mainak Ganguly [MU - Jaipur]
2	Radhika Malav [Ph.D (SBS) - 2021]
3	Dr. Susruta Samanta [MU - Jaipur]
4	Dr. Veena Dhayal [MU - Jaipur]
5	Dr. Suranjan De [MUJ]
6	Megha [Ph.D (SBS) - 2021]
7	Pooja Saini [Ph.D - 2020]
8	Dr. Senthil (Guest)
9	Ankita Kumawat [BSC (Hons Chemistry) - 2021]
10	Shurti Grag (BSC Hons student_
11	Dr. Amrita Biswas [MUJ]
12	Muskan Khandelwal [BSC (Hons Chemistry) - 2021]
13	Karunya Papney [BSC (Hons Chemistry) - 2021]
14	Dr. Sriparna Ray (Guest)
15	Kanika [BSC (Hons Chemistry) - 2021]
16	Shakir Irfan [Ph.D - 2020]

17	Khushi Verma [BSC (Hons Chemistry) - 2021]
18	Hitlesh Ajmera [BSc (Chemistry) - 2019]
19	Suman Yadav [BSc (Chemistry) - 2019]
20	Aashish Sharma [BSc (Chemistry) - 2019]
21	Mohini Jangid (Guest)
22	Dr. Sriparna Ray [MUJ]

Link for event: https://teams.microsoft.com/l/meetup-join/19%3auDbsKnkFkDQdbznt8htjPHNBF5st5wuBXlNstBzVOYI1%40thread.tacv2/1640769451374?context=%7b%22Tid%22%3a%22a1608842-8390-4bfb-90af-89ae3ab30761%22%2c%22Oid%22%3a%224541d029-8987-4e67-aad1-677413a6b4a4%22%7d\

NISE

INDIA NON JUDICIAL

Government of National Capital Territory of Delhi

e-Stamp

सत्यमेव जयते

Certificate No.	:	IN-DL101181548432O9T
Certificate Issued Date	:	13-Aug-2021 11:47 AM
Account Reference	:	SELFPRINT (PU)/ dl-self/ NEHRU/ DL-DLH
Unique Doc. Reference	:	SUBIN-DLDL-SELF17617819805831T
Purchased by	:	NATIONAL INSTITUTE OF SOLAR ENERGY YOGENDRA
Description of Document	:	Article 5 General Agreement
Property Description	:	MEMORANDUM OF AGREEMENT BETWEEN NISE GURUGRAM AND MANIPAL UNIVERSITY JAIPUR
Consideration Price (Rs.)	:	0 (Zero)
First Party	:	NATIONAL INSTITUTE OF SOLAR ENERGY
Second Party	:	MANIPAL UNIVERSITY JAIPUR
Stamp Duty Paid By	:	NATIONAL INSTITUTE OF SOLAR ENERGY
Stamp Duty Amount(Rs.)	:	100 (One Hundred only)

SELF PRINTED CERTIFICATE
TO BE VERIFIED BY THE RECIPIENT

Please write or type below this line

Memorandum of Understanding

This Memorandum of Understanding (hereinafter referred to as "this MoU") is signed on the 16th Day of August, 2021

BETWEEN

National Institute of Solar Energy (NISE)
Gurugram, Haryana as First Party

And

Manipal University Jaipur
Jaipur, Rajasthan as Second Party

Statutory Alert:

MANIPAL UNIVERSITY JAIPUR

राष्ट्रीय सौर ऊर्जा संस्थान (नवीन और नवीकरणीय ऊर्जा मंत्रालय का स्वशासी संस्थान) National Institute of Solar Energy (An Autonomous Institute of MNRE) NISE गुरुग्राम Gurugram

NISE

National Institute of Solar Energy, an autonomous institution of Ministry of New and Renewable Energy (MNRE), is the apex National R&D institution in the field of Solar Energy established on 28th October, 2013. NISE assist the Ministry in implementing the National Solar Mission and to coordinate research, technology and other related works. NISE is located on Gurugram-Faridabad road, about 8 km from central Gurugram (Hereinafter referred to as **"NISE"** which expression shall unless repugnant to the context or meaning thereof, mean and include its successors, executors and permitted assigns) of the First Part;

AND

Manipal University Jaipur an education institution established under THE MANIPAL UNIVERSITY JAIPUR ACT, 2011 (Act No. 21 of 2011) dated 04th June, 2011 having its campus at **Village and Post: Dehmi Kalan, Tehsil Sanganer, Jaipur-Ajmer Expressway, Jaipur, Rajasthan 303007** (hereinafter referred to as **"MUJ"**), of the second part;

(NISE, and MUJ shall hereinafter referred to collectively as "Parties" and individually as "Party", where the context so requires)

WHEREAS

A. National Institute of Solar Energy as an apex institute of the Ministry of New and Renewable Energy, in the area of solar energy is undertaking activities related to research & development, testing, certification, standardization, skill development, resource assessment and awareness in the field of solar energy and associated technologies. The institute is committed to the development and demonstration of solar energy related technologies and its applications to the common man in the country. NISE continuously strives to improve the facilities so as to compete with the latest technological advancements.

B. MUJ uses the latest and innovative methods and technology to impart education. The multidisciplinary MUJ offers career-oriented courses at all levels, i.e., UG, PG and Doctoral and across diverse streams, including Engineering, Architecture, Planning, Humanities, Commerce, Management, Communication, Basic Sciences, etc.

C. The Parties, leveraging on the existing core functions of each organisation in developing a solar energy-based industry in the region, are desirous of entering into this Memorandum of Understanding to declare their respective intentions and to establish a basis of co-operation and collaboration between the Parties upon the terms as contained herein.

MANIPAL UNIVERSITY JAIPUR

राष्ट्रीय सौर ऊर्जा संस्थान National Institute of Solar Energy NISE गुरूग्राम Gurugram (An Autonomous Institute of MNRE) नवीकरणीय ऊर्जा मंत्रालय का स्वतन्त्र संस्थान

THE PARTIES HEREBY REACHED THE FOLLOWING UNDERSTANDINGS:

1. OBJECTIVE

The Parties, subject to the terms of this MoU and the laws, rules, regulations and national policies from time to time in force, may endeavour to strengthen, promote and develop co-operation between the Parties on the basis of equality and mutual benefit.

2. AREAS OF CO-OPERATION

2.1 Subject to the laws, rules, regulations and national policies from time to time in force, governing the subject matter, each Party may act as a stimulus for a wide range of collaborative activities, including but not limited to the collaboration related to research, innovation, testing and technology transfer in midstream and downstream sector of the industry.

2.2 For the above collaboration, the areas to be covered could include (but not limited to) the following areas:

i. Collaborate to identify key R&D areas for immediate and future requirements of country in field of solar and hydrogen energy.
ii. Exploring Collaborated Research, submission of Research Proposal to any funding agencies.
iii. NISE and MUJ will utilize each other facilities and infrastructure on mutually agreeable terms for research, testing and experimental purposes.
iv. Collaboratively work on performance analysis, characterization, piloting and long-term evaluation of the developed products.
v. Perform techno-commercial analysis of the developed products and understand the relative merit against other available options.
vi. Joint Training / Workshop to exchange of knowledge between NISE and MUJ researchers/ Members / Stakeholders.
vii. Jointly write journal papers, conference papers and other material to publish the results of the work.
viii. Jointly file patent and get intellectual property (IP) rights for the developed technology/product/process/system.
ix. To exchange information on research and educational programmes,
x. To exchange information on teaching, learning material and other literature relevant to their educational and research programmes

2.3 For the purpose of implementing the co-operation in respect of any area stated in clause 2, the parties may enter into a legally binding agreement subject to terms and conditions as mutually agreed upon by the Parties.

MANIPAL UNIVERSITY JAIPUR

राष्ट्रीय सौर ऊर्जा संस्थान National Institute of Solar Energy (An Autonomous Institute of MNRE) नवीन एवं नवीकरणीय ऊर्जा मंत्रालय का स्वायत्त संस्थान NISE गुरुग्राम Gurugram

3. FINANCIAL ARRANGEMENTS

This MoU will not give rise to any financial obligation by one party to the other. Each party will bear its own cost and expenses in relation to this MoU.

4. EFFECT OF MEMORANDUM OF UNDERSTANDING

Notwithstanding the statements and obligations herein, this MoU shall not create a legal relationship between the Parties and the Parties shall not be legally bound until and unless a definitive agreement has been negotiated and duly executed by the authorized representatives of the Parties.

5. NO AGENCY

Nothing contained herein is to be constituted as a joint-venture partnership or formal business organization of any kind between the Parties or so to constitute either party as the agent of the other.

6. ENTRY INTO EFFECT AND DURATION

6.1 This MoU will come into effect on the date of signing and will remain in effect for a period of two (2) years.

6.2. This MoU may be renewed for a further period as may be agreed in writing by the Parties.

6.3. This MoU may be terminated at any time by either party giving the other party a written notice of no less than one (1) month.

7. NOTICES

Any communication under this MoU will be in writing in the English language and delivered by registered mail and/or courier to the address or sent to the electronic mail address of the Parties or as the case may be, shown below or to such other address or electronic mail address or facsimile number as either party may have notified the sender and shall, unless otherwise provided herein, be deemed to be duly given or made when delivered to the recipient at such address or electronic mail address or facsimile number which is duly acknowledged:

MANIPAL UNIVERSITY JAIPUR

राष्ट्रीय सौर ऊर्जा संस्थान ★ National Institute of Solar Energy ★ NiSE गुरूग्राम Gurugram (An Autonomous Institute of MNRE) नवीकरणीय ऊर्जा मंत्रालय का स्वायत्त संस्थान

To	:	**NATIONAL INSTITUTE OF SOLAR ENERGY (NISE)**
Attn to	:	Director General
Address	:	Gwal Pahari, Faridabad – Gurugram Road, Gurugram – 122003, Haryana.
Tel no.	:	+91 124 285 3060
E-mail	:	nise.mnre@gmail.com

To	:	**MANIPAL UNIVERSITY JAIPUR (MUJ)**
Attn to	:	Registrar
Address	:	Dehmi Kalan, Jaipur-Ajmer Expressway, Jaipur 303007, Raj.
Tel no.	:	+91 141 3999 100
E-mail	:	registrar@jaipur.manipal.edu

8. PROTECTION OF INTELLECTUAL PROPERTY RIGHTS

8.1. The protection of intellectual property rights shall enforced in conformity with the respective national laws, rules and regulations of the Parties and with international agreements signed by both Parties.

8.2. The use of the name, logo and/or official emblem of any of the Parties on any publication, document and/or paper is prohibited without the prior written approval of either Party.

8.3. Notwithstanding anything in paragraph 8.1 above, the intellectual property rights in respect of any technological development, and any products and services development, carried out

i. Jointly by the Parties or research results obtained through the joint activity effort of the Parties, shall be jointly owned by the Parties in accordance with the terms to be mutually agreed upon; and

ii. Solely and separately by the Party or the research results obtained through the sole and separate effort of the Party, shall be solely owned by the Party concerned.

9. CONFIDENTIALITY

9.1. Each Party shall undertake to observe the confidentiality and secrecy of document, information and other data received from or supplied to, the other Party during the period of the implementation of this MoU or any other agreements made pursuant to this MoU.

MANIPAL UNIVERSITY JAIPUR

NISE गुरुग्राम Gurugram

9.2. For the purpose of paragraph 9.1 above, such documents, information and data include any document, information and data which is disclosed by a party (the disclosing party) to the other party (the receiving party) prior to, or after, the execution of this MoU, involving technical, business, marketing, policy, know-how, planning, project management and other documents, information, data and/or solutions in any form, including but not limited to any document, information or data which is designated in writing to be confidential or by its nature intended to be for the knowledge of the receiving party or if orally given, is given in the circumstances of confidence.

9.3. Both Parties agree that the provisions of this Article may continue to be binding between the Parties notwithstanding the termination of this MoU.

10. SUSPENSION

Each party reserves the right for reasons of national security, national interest, public health to suspend temporarily, either in whole or in part, and the implementation of this MoU which suspension shall take effect immediately after notification has been given to the other party.

11. SETTLEMENT OF DISPUTES

Any difference or dispute between the Parties concerning the interpretation and/or implementation and/or application of any of the provisions of this MoU shall be settled amicably through mutual consultation and/or negotiations between the Parties, without reference to any third party or international tribunal. Director General, NISE and Registrar, MUJ will jointly resolve the dispute in a spirit of independence, mutual respect, and shared responsibility.

12. VARIATION

The terms stipulated in this MoU shall not be amended, altered, changed or otherwise modified without the mutual consent of the Parties and such amendments, alterations, changes and modifications shall be made in writing and signed by the Parties hereto.

MANIPAL UNIVERSITY JAIPUR

राष्ट्रीय सौर ऊर्जा संस्थान National Institute of Solar Energy NiSE गुरुग्राम Gurugram (An Autonomous Institute of MNRE) नवीकरणीय ऊर्जा मंत्रालय का स्वायत्त संस्थान

NISE

The undersigned being duly authorized thereto have signed this Memorandum of Understanding.

SIGNED through online mode on this 16th day of August 2021 in two originals in the English language.

Signed by on behalf of National Institute of Solar Energy (NISE)	Signed by on behalf of Manipal University Jaipur (MUJ)
Dr. Arun K. Tripathi Director General Date: 16.08.2021	Dr. Nitu Bhatnagar Registrar Date: 13/09/2021
Witness: Name & Address: Dr. Jai Prakash NISE	Witness: Name & Address: Dr. Kulwant Singh.
Signature: Date: 16.08.2021	Signature: Date:

MANIPAL UNIVERSITY JAIPUR

राष्ट्रीय सौर ऊर्जा संस्थान ★ National Institute of Solar Energy ★ NiSE गुरूग्राम Gurugram (An Autonomous Institute of MNRE) नवीन एवं नवीकरणीय ऊर्जा मंत्रालय का स्वयत्त संस्थान

MANIPAL UNIVERSITY JAIPUR

Established under Act No. 21 of 2011, State of Rajasthan; Recognised u/s 2(f) UGC Act, 1956

Genus energizing lives

Memorandum of Understanding
between
Manipal University Jaipur
and
Genus Power Infrastructure Ltd., Jaipur

This memorandum of understanding (MOU) is entered on **28th July 2021** between Manipal University Jaipur, an educational institution existing under THE MANIPAL UNIVERSITY JAIPUR ACT, 2011 , Act No. 21 of 2011 dated 12th September, 2011 and is recognized by the UGC under section 2(F) of the UGC Act, 1956, having its campus at Dehmi Kalan, Near GVK Toll Plaza, Jaipur-Ajmer Expressway, Jaipur, Rajasthan 303007 (hereinafter referred to as **"MUJ"** which expression shall, unless repugnant to the context or meaning thereof, be deemed to mean and include its successors-in-interest and assigns) Party of the First Part;

And

Genus Power Infrastructure Ltd., a Company incorporated under the Indian Companies Act, 1956 and having its Registered Office at Sitapura Industrial Area, Jaipur -302017, Rajasthan, India (hereinafter referred to as **"Genus"** which expression shall, unless it be repugnant to the context or meaning thereof, be deemed to mean and include its successors-in-interest and assigns) Party of the Second part.

Genus is in the business of design, manufacture, sales and service of products and systems for managing energy - including, but not limited to, electricity meters, gas meters, communication hubs and modems, measuring instruments, controls, smart home products, electrical and energy systems etc. Along with software and services that helps users save, reduce energy use and live in comfort. Genus has extensive knowledge and expertise in the creation and development of technical information, ideas, and concepts relating to software, hardware and business processes for the Electric, Gas and Water

Utilities, Energy Metering, Energy Management, Home Controls industry including markets, competition, pricing, and implementation and designs for such systems including hardware, software and business processes.

The Manipal Global Education Group, with its heritage of excellence in higher education for over 60 years, launched Manipal University Jaipur (MUJ) in 2011. The university uses the latest and innovative methods and technology to impart education. The multidisciplinary university offers career-oriented courses at all levels, i.e., UG, PG and Doctoral and across diverse streams, including Engineering, Architecture, Planning, Fashion Design, Hospitality, Allied Health Sciences, Humanities, Commerce, Management, Communication, Basic Sciences, Fashion Design and Jewelry Management, etc.

Genus and **MUJ** are desirous of promoting industry-academia collaboration - in various fields which will be beneficial to both the Parties.

Objectives of the MOU:

To improve employability of the students and enhance the visibility of Genus amongst students of MUJ by implementing/engaging in various programs.

Genus and **MUJ** hereby agree to extend cooperation for furthering the Industry academia collaboration for mutual benefit.

1. Genus to provide industrial exposure to the selected engineering students of MUJ by way of last semester internship to the extent of feasibility and requirement.
2. Genus to nominate technical & professional skill experts to deliver guest lectures to the students / faculty on mutual agreement.
3. Genus to provide suggestions from industry perspective for design / modification of course curriculum to the extent of feasibility.
4. Genus to allow the access to designated staff and students of MUJ to visit the premises of its manufacturing plants on mutual agreement.
5. Genus may consider for endowment of its products or instruments to MUJ for a real life learning platform.
6. MUJ to incorporate the mutually agreed suggestions for improvement of the quality of education imparted.
7. MUJ to extend logistics support and ensure maximum participation from expected audience during any planned session of Genus.
8. MUJ will provide the support and encourage the employees of Genus for higher education programs as per MUJ norms and guidelines laid through mutual agreement.
9. MUJ to consider Genus as a preferred employer.

1. Confidentiality / Secrecy

MUJ and its students, its employees and anyone acting under it for the purpose of this MOU shall maintain strict confidentiality of the information belonging to Genus that may have come into its / their possession or knowledge because of the collaboration activities under this MOU. Such information shall not be divested or disclosed to any other third party under any circumstances, whatsoever, without obtaining prior written approval from Genus.

"Confidential Information" in this MOU shall mean confidential information and proprietary information concerning Genus including and without limitation; trade secrets, secret information, technical processes, finances, software language codes, any research material, text, dealings and method of dealings with the clients or the customers and its employees together with similar information of confidential or proprietary nature relating to Genus's suppliers, employees, agents, distributors, and customers and relationships of special trust and confidence with the clients or customers and employees.

MUJ may be exposed to Genus or any of its associate company's Confidential Information. MUJ agrees that, during and after the term of this MOU, it shall use the Confidential Information solely for purposes of performing its obligations and/or exercising its rights under this MOU, and shall not disclose to any third party any Confidential Information without the prior written consent of Genus. MUJ may disclose the Confidential Information only to its personnel / employees, students as is reasonably necessary to allow MUJ to perform its obligations under this MOU and to obtain the benefits thereof, provided that each such personnel / employee / student is under a written obligation of non-disclosure which protects the Confidential Information under terms substantially similar to those herein. MUJ will ensure full security of Genus's data and documents. All the actual data of Genus in form of documents and database (either soft and or hard copies) with MUJ will be discarded upon expiry or early termination of this MOU. MUJ shall not use the Confidential Information of Genus to procure a commercial advantage over Genus.

All obligations respecting the Confidential Information already provided hereunder shall survive any termination of this MOU.

2. Non-Exclusivity

The relationship of the parties under this MOU shall be nonexclusive and both Parties, including their affiliates, subsidiaries and divisions are free to pursue other collaborations of any kind.

3. Term & Termination

This MOU shall be effective from the date of signing and for a period of three years. This Agreement may be terminated by either Party upon fifteen (15) days prior written intimation.

4. Costs and Expenses

Each Party hereto shall be responsible for its own respective costs, risk and expenses involved in this MOU.

5. Assignment

This MOU is not assignable or transferable by either Party without the prior written consent of the other Party.

6. Dispute Resolution

Any dispute arising due to terms and conditions of this MOU or interpretation thereof, shall be referred to a sole arbitrator appointed mutually by the parties. The arbitration venue shall be at Jaipur, Rajasthan and the arbitration proceedings shall be conducted as per the provisions contained in the Arbitration & Conciliation Act 1996.

The courts situated at Jaipur Rajasthan shall have exclusive jurisdiction over the legal matters arising out of this MOU.

7. Nodal Officers:

Manipal University, Jaipur:

1) Dr. Rajveer Singh Shekhawat, Director, School of Computing and IT
   Email: rajveersingh.shekhawat@jaipur.manipal.edu (+918003599920)
2) Dr. Ashish Shrivastava, Professor and Head, Department of Electrical Engineering
   Email: ashish.shrivastava@jaipur.manipal.edu (+919811490210)

Genus Power Infrastructure Limited, Jaipur

Mr. Arjya Kumar Mishra, Head, Human Resources- Corporate

Email: arjya.mishra@genus.in

MANIPAL UNIVERSITY • JAIPUR •

IN WITNESS WHEREOF THE PARTIES HERETO HAVE SIGNED THIS MEMORANDUM OF UNDERSTANDING ON THE DATE WRITTEN ABOVE:

For Manipal University Jaipur:	**For Genus Power Infrastructure Ltd:**
Prof. (Dr.) H Ravishankar Kamath	**Arjya Kumar Mishra**
Registrar, Manipal University Jaipur (MUJ)	Head, Human Resources- Corporate
Signed in Jaipur, India:	Signed in Jaipur, India:

SECURE

MEMORANDUM OF UNDERSTANDING

This memorandum of undertaking (MOU) is entered on 26th day of November, 2019 between **Manipal University** an education institution existing under THE MANIPAL UNIVERSITY, JAIPUR ACT, 2011 , Act No. 21 of 2011 dated 12th September, 2011 having its campus at **Dehmi Kalan, Near GVK Toll Plaza, Jaipur-Ajmer Expressway, Jaipur, Rajasthan 303007** (hereinafter referred to as **"MUJ"** which expression shall, unless repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns) of the First Part

And

Secure Meters Ltd, a Company incorporated under the Indian Companies Act, 1956 and having its Registered Office at **E-Class, Pratapnagar Industrial Area, Udaipur -313003, Rajasthan, India** (herein referred as **"Secure"** which expression shall, unless it be repugnant to the context or meaning thereof, be deemed to mean and include its successors and assigns) of the Second part

Secure is in the business of design, manufacture, sales and service of products and systems for managing energy - including, but not limited to, electricity meters, gas meters, communication hubs and modems, measuring instruments, controls, smart home products, pump efficiency along with software and services that helps users save, reduce energy use and live in comfort. Secure has extensive knowledge and expertise in the creation and development of technical information, ideas, and concepts relating to software, hardware and business processes for the Electric, Gas and Water Utilities, Energy Metering, Energy Management, Home Controls industry including markets, competition, pricing, and implementation and designs for such systems including hardware, software and business processes.

The Manipal Education Group, with its heritage of excellence in higher education for over 60 years, launched Manipal University Jaipur (MUJ) in 2011. The university uses the latest and innovative methods and technology to impart education. The multidisciplinary university offers career-oriented courses at all levels, i.e., UG, PG and Doctoral and across diverse streams, including Engineering, Architecture, Planning, Fashion Design, Hospitality, Allied Health Sciences, Humanities, Commerce, Management, Communication, Basic Sciences, Fashion Design and Jewellery Management, etc.

Secure and MUJ are desirous of promoting industry-academia collaboration - in various fields which will be beneficial to both the Parties.

Objectives of the MOU:

To improve employability of the students and enhance the visibility of Secure amongst students of the MUJ by implementing/engaging in various programs.

Secure and **MUJ** hereby agree to extend cooperation for furthering the Industry academia collaboration for mutual benefit.

1. Secure to nominate technical & professional skill experts to deliver guest lectures to the students / faculty on mutual agreement.
2. Secure to provide suggestion from industry perspective for design / modification of course curriculum to the extent of feasibility.

Secure Meters Limited
F 373-380
Bhamashah Industrial Area
Kaladwas, Udaipur 313 003, India

p: +91 294 2650301-305
f: +91 294 2650310
e: udaipur@securemeters.com

Regd. & Head Office
"E" Class
Pratapnagar Industrial Area
Udaipur 313 003, India
CIN No: U74899RJ1987PLC029106

p: +91 294 2492300-305
f: +91 294 2492310
e: mktg@securemeters.com
www.securemeters.com

3. Secure to participate in colleges' convocations/ technical fest/ seminar/ conferences as appropriate.
4. Secure to allow the access of designated staff and students of the institute to visit the premises of manufacturing plants on mutual agreement.
5. Secure to provide industrial exposure to the selected engineering students of the institute by way of last semester internship to the extent of feasibility and requirement.
6. Secure may consider for endowment of its products or instruments to the Institute labs for a real life learning platform.
7. MUJ to incorporate the mutually agreed suggestions made by Secure for improvement of the quality of education imparted.
8. MUJ to extend logistics support and ensure maximum participation from expected audience during any planned session of Secure.
9. MUJ to consider Secure as a preferred employer.

1. Confidentiality / Secrecy

The Institute and its students, its employees and anyone acting under it for the purpose of this MOU shall maintain strict confidentiality of the information belonging to **Secure** that may have come into its / their possession or knowledge because of the collaboration activities under this MOU. Such information shall not be divested or disclosed to any other third party under any circumstances, whatsoever, without obtaining prior written approval from **Secure.**

"Confidential Information" in this MOU shall mean confidential information and proprietary information concerning **Secure** including and without limitation; trade secrets, secret information, technical processes, finances, software language codes, any research material, text, dealings and method of dealings with the clients or the customers and its employees together with similar information of confidential or proprietary nature relating to Secure's suppliers, employees, agents, distributors, and customers and relationships of special trust and confidence with the clients or customers and employees.

The Institute may be exposed to **Secure** or any of its associate company's Confidential Information. The Institute agrees that, during and after the term of this MOU, it shall use the Confidential Information solely for purposes of performing its obligations and/or exercising its rights under this MOU, and shall not disclose to any third party any Confidential Information without the prior written consent of Secure. The Institute may disclose the Confidential Information only to its personnel / employees, students as is reasonably necessary to allow the Institute to perform its obligations under this MOU and to obtain the benefits thereof, provided that each such personnel / employee / student is under a written obligation of non-disclosure which protects the Confidential Information under terms substantially similar to those herein. The Institute will ensure full security of Secure's data and documents. All the actual data of Secure in form of documents and database (either soft and or hard copies) with the Institute will be discarded upon expiry or early termination of this MOU. The Institute shall not use the Confidential Information of Secure to procure a commercial advantage over Secure.

All obligations respecting the Confidential Information already provided hereunder shall survive any termination of this MOU.

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Udaipur 313 003, India
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e: mktg@securemeters.com
www.securemeters.com

SECURE

2. Non-Exclusivity

The relationship of the parties under this MOU shall be nonexclusive and both Parties, including their affiliates, subsidiaries and divisions are free to pursue other collaborations of any kind.

3. Term & Termination

This MOU shall be effective from 26th Nov 2019 to 25th Nov 2022. This Agreement may be terminated by either Party upon fifteen (15) days prior written intimation.

4. Costs and Expenses

Each Party hereto shall be responsible for its own respective costs, risk and expenses involved in this MOU.

5. Assignment

This MOU is not assignable or transferable by either Party without the written consent of the other Party.

6. Representatives:

Manipal University, Jaipur:
Dr. Sandeep Chaurasia , Associate Professor | Computer Science & Engineering Department
Mob. :9571228110
Email: Sandeep.Chaurasia@jaipur.manipal.edu

Secure Meters Limited, Udaipur
Ms. Pooja Semwal, Manager - Talent Management
Email: Pooja.semwal@securemeters.com

IN WITNESS WHEREOF THE PARTIES HERETO HAVE SIGNED THIS MEMORANDUM OF UNDERSTANDING ON THE DATE WRITTEN ABOVE:

Signed, sealed and delivered through its authorized signatory:	Signed, sealed and delivered through its authorized signatory:
Secure Meters Ltd, Udaipur **Sanjay Srivastava** **Site Head - Udaipur Operations & HR Business Partner - Global Operations**	**Manipal University Jaipur** **Prof (Dr) H Ravishankar Kamath , Registrar, Manipal University Jaipur**

SECURE METERS LTD. (A.U.) UDAIPUR

MANIPAL UNIVERSITY JAIPUR

MANIPAL UNIVERSITY JAIPUR

INSPIRED BY LIFE

7 AFFORDABLE AND CLEAN ENERGY

Manipal University Jaipur Driving Clean Energy and Energy-Efficient Technology Support for Government

The global community faces escalating challenges due to climate change, amplified by carbon emissions and the depletion of natural resources. To counter these challenges, a shift to clean energy and energy-efficient technologies is imperative. Recognizing this urgency, Manipal University Jaipur has stepped forward to spearhead research, innovation, and policy support in this crucial arena.

Manipal University Jaipur serves as hubs for cutting-edge research, generating insights crucial for policymakers. The faculties and research centers conduct extensive studies to understand the viability, impact, and potential of clean energy solutions. Through reports, white papers, and direct collaborations with government bodies, universities provide evidence-based guidance that informs policy decisions. Manipal University Jaipur, research and development departments are driving forces behind the creation of new energy-efficient technologies. From solar panels to energy storage systems, Manipal University Jaipur is at the forefront of innovation, continually seeking ways to improve the efficiency and sustainability of energy production and consumption. Manipal University Jaipur offers specialized programs and courses focusing on clean energy and sustainable technologies. These initiatives equip students with the knowledge and skills required to support government efforts in implementing clean energy policies and technologies. Manipal University Jaipur collaborates with governments and industry partners to develop and implement strategies for clean energy adoption. These collaborations foster a fertile ground for practical applications of research findings, leading to the development of real-world solutions that align with government objectives. Manipal University Jaipur's outreach efforts also support local and global initiatives aimed at promoting clean energy and energy efficiency. They actively participate in climate action events, conferences, and policy discussions, contributing expertise and promoting sustainable practices.

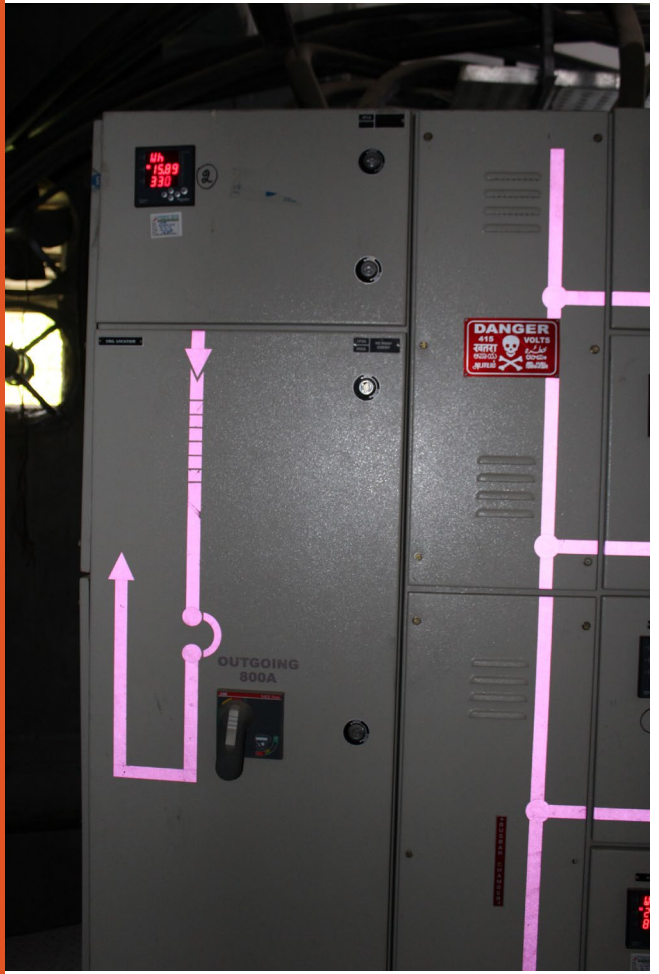
The dedication of Manipal University Jaipur to research, inform policy, foster innovation, and educate the future workforce underscores the shift to clean energy and energy-efficient technologies. By continuously refining and implementing solutions, Manipal University Jaipur is supporting governments and paves the way for a more sustainable and resilient energy future.

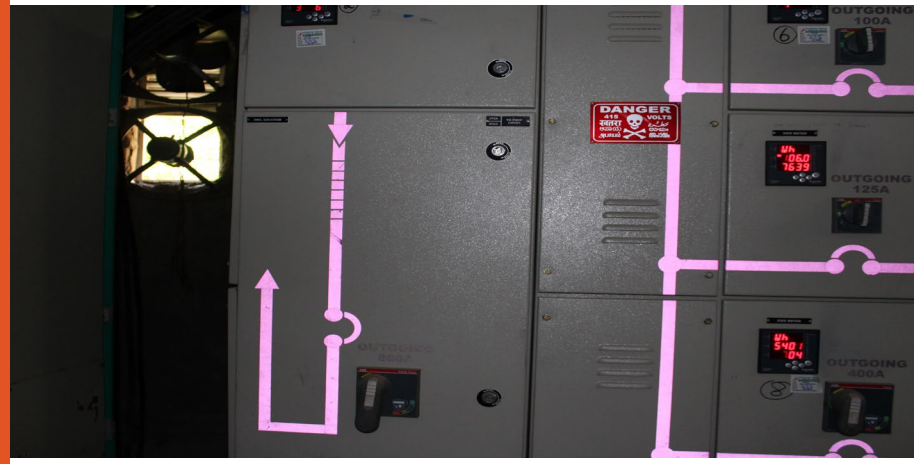
In a world seeking sustainable solutions, the collaborative efforts between Manipal University Jaipur and government stand as beacons of hope. The knowledge exchange, innovation, and policy support from Manipal University Jaipur is integral to steering the world towards a future powered by clean energy and energy-efficient technology. Together, these partnerships form the backbone of progress, fostering a collective commitment towards a more sustainable and environmentally responsible energy landscape.

Projects on Energy Efficiency

RENEWABLE ENERGY SOURCES

RESOURCE CONSUMPTION MONITORING





MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

RENEWABLE ENERGY UTLIZATION AT MANIPAL UNIVERSITY JAIPUR

Renewable energy Utilization is a key part of the design and development at Manipal University Jaipur. Hence, on site energy generation was given precedence to offset at least 50% of the total energy demand to achieve this solar p.v arrays are installed on the rooftops across all the major buildings in the University.

Key Performance Indicators:

The approach of MUJ to race towards self sufficiency in Energy is by reducing overall energy demand of MUJ (Admin & Academic-1) wherever possible. Design optimization was the key aspect which is driving MUJ to achieve energy use reduction. The reduced energy will be met by on site generated solar energy

- Climate responsive design of the building is the key element in the reduced energy demands.
- Appropriately sized systems with energy efficient technology & controls further reduced the energy demands
- Design has considered the orientation of building to construct the service structures on roof to reduce the amount of self shading & shadow patches on roof to maximum energy harvest with the solar pv's.
- Constant increase in capacity of solar PV system to steady offset of conventional energy demands

➢ Usage Details Report (click here)

ENERGY AUDIT

Document ID: IPPL/EA/ND/19-20/01

ENERGY SAVING SUMMARY

S.No	Energy Conservation Projects	Annual Water Saving (KL)	Annual Energy Saving (KVAh)	Annual Monetary Saving in Lakhs	Investment (in lakhs) Rs.	Payback Period in Months	Co2 Emission Reduction in Ton	Page No
1	Avoiding use of transformer-1 during non-peak months		21,818	2.05	1.5	9	17.9	54
2	Maintaining 410-415 V instead of 430 V at Transformer-1		1,40,695	13.23	Nil	Immediate	115.4	55
3	Energy saving achieved by Chiller set point optimisation		13,745	1.29	Nil	Immediate	11.3	57
4	Energy saving by chiller plant optimisation		43,636	4.10	Nil	Immediate	35.8	59
5	Installation of Automation in Unitary AC		7,987.2	0.75	1.2	19	6.5	63
6	Replacement of Old AC by Inverter AC		3,840	0.36	1.2	40	3.1	63
7	Increase Re-use of Grey-Waste Water from laundry	4000		9.76	15.0	18	-	68
8	Energy saving by using fine bubble diffuser		44,460.6	4.26	5.0	14.2	36.5	71
9	Aggregation and optimisation of compressed air usage in STP		3,625.3	0.34	0.5	17.8	3.0	74
10	Installation of Energy efficient fans		2,40,000	22.56	90.0	48	196.8	79
11	Replacement of Inefficient Heat Pumps (Either by new heat pump or through staform hot water system)		49,332.8	5.1	7.8	18.5	40.5	81
12	Cleaning and Maintenance of Heat pumps to improve COP		39,926.3	3.8	6.0	19.2	32.7	83
13	Installation of Solar street light at peripheral roads		24,741.8	2.3	9.5	48.8	20.3	85
Total		**4000**	**6,33,809**	**70**	**138**	**24**	**520**	





Energy Audit Report

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

External Participation – Technology Driven Env. & Sustainable Solutions 28

Manipal University Jaipur, part of the Global Sanitation Learning Alliance a project by UNESCO-IHE & Bill & Melinda Gates Foundation

BILL & MELINDA GATES foundation

UNESCO | IHE DELFT

UNESCO/IHE DELFT

and

BILL & MELINDA GATES FOUNDATION

MUJ received an approved grant of 363,000=00 USD (2.6 Crores) from Bill & Melinda Gates Foundation through top Global Institute , IHE Delft Netherlands to run

a) OnLine course in Non Sewered sanitation
b) Diploma Courses in Non Sewered Sanitation
c) MTech in Non Sewered Sanitation

Principal Investigator : Prof A D Vyas
Co PI : Dr Meena Kumari Sharma
Dr Monika Sogani
Mr Sagar Gupta

Duration: Aug 2019- Dec 2023

Conference, Workshop, Seminars

1. Organized faculty development program on Waste Management during 2-6 November, 2020.
2. Expert lecture on “Community based research interventions n environmental science and engineering: the key to a sustainable and healthy society” by Prof. A.B.Gupta, from MNIT Jaipur.
3. Expert lecture on “Selection of Proper Waste Technology as part of Waste Management Infrastructure” by Prof Brajesh Dubey from IIT Kharagpur
4. Expert lecture on “Waste Technology on Feacal Sludge and Septage Management (ODF++)” by Prof Srinivas Chary Vedala, Director, Administrative Staff College, India
5. Waste Technology on business models for faecal sludge management” by Prof Dinesh Mehta, Professor Emeritus at CEPT University
6. Expert lecture on “*Waste Technology on Selection of Proper Waste Technology as part of Waste Management Infrastructure*” by Prof. A.B.Gupta, from MNIT Jaipur.

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

External Participation – Technology Driven Env. & Sustainable - Projects

S. No.	Lead/Principal Investigator (PI)	Co-PI (If any)	Title of Project	Funding Agency
1	**Dr Monika Sogani**	Prof A D Vyas, Meena Kumari, Sagar Gupta	Delawas STP & its impact on socio economic conditions	Asian Development Bank Institute, Japan
2	**Prof A D Vyas**	Dr. Monika Sogani, Dr Meena Kumari Sharma and Mr Sagar Gupta	Short term actions in FSM, awareness in academic institutions	UNESCO/IHE Delft, Netherlands and Bill and Melinda Gates Foundation
3	**Dr. Meena Kumari Sharma**	Prof. A.D. Vyas & Mr. Sagar Gupta	Performance of low cost community based onsite sanitation system in Ambient Environment	DST, Rajasthan
4	**Prof. A D Vyas**	Dr. Meena Kumari Sharma, Dr Monika Sogani, Mr. Sagar Gupta	On line course on Faecal Sludge Management	UNESCO/IHE, Delft, Netherlands and Bill and Melinda Gates
5	Dr Monika Sogani	Dr Meena Kumari Sharma & Prof. A. D. Vyas	Enhanced biodegradation of organic pollutants as well as micro-pollutants	Science and Engineering Research Board (SERB), DST, Govt. of India
6	**Prof Lalita Ledwani**	Prof. A D Vyas, Dr Pushpendra Kr	Water sector Grant	Kurita Water Environment Fund, Japan

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

Ongoing Projects of sustainable solution for society

Final Flus

- Using hyperboloid mathematical model to separate solid and liquid mechanically

Future Waste Technologies Limited: a startup which is smartly manage the waste of a smart city. It has a waste managing app, place smart dustbins, smart waste collecting trucks, smart waste managing units for biodegradable, recyclable and non-biodegradable wastes. Thus, preventing any problems of waste.

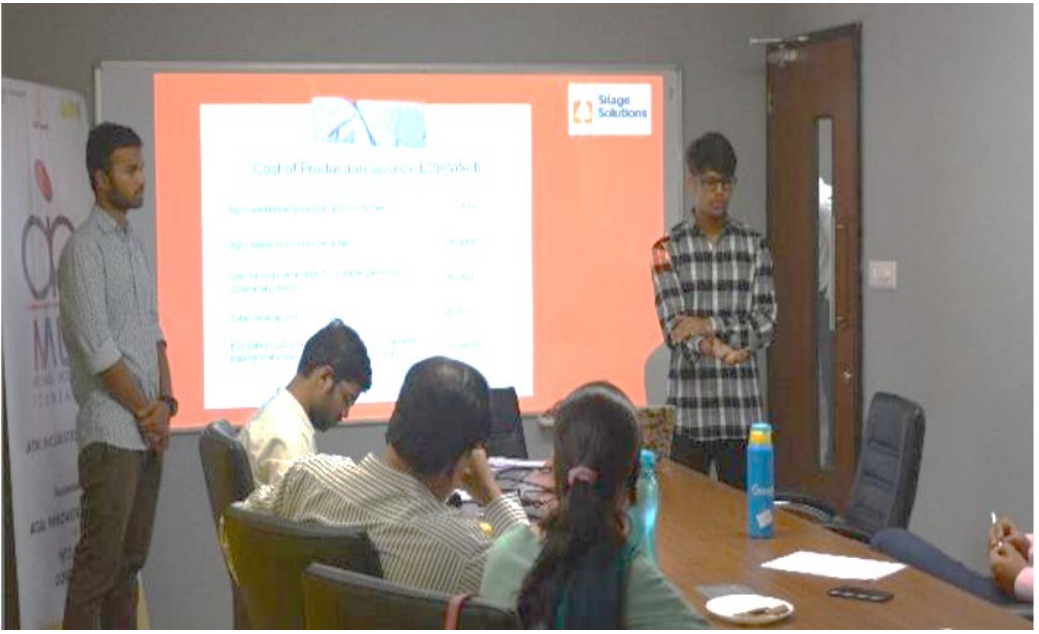
GARBO
Aim to create awareness amongst common households by analyzing their everyday garbage and providing them with more environmentally friendly replacements.

Astute Conurbation: a project which is going to provide solution for waste management, water management by providing a new way to transfer it directly from home to waste treatment plant, and also going to bring technical advancement to our railway stations where we often see mismanagement, also further it is launching special purpose vehicle for different purposes. Also, it will be introducing Energy conservation products, Green energy building.

Silage Solutions works on developing products and processes to produce eco-friendly, affordable and high-quality items to replace single-use plastics, using crop residue which is otherwise burnt on the fields causing air pollution and respiratory diseases. It encourages farmers to use eco-friendly waste management techniques thus providing a secondary source of income.
Second

MANIPAL UNIVERSITY
JAIPUR
(University under Section 2(f) of the UGC Act)

Ongoing Projects of sustainable solution for society



SmartFarm working with the aim of supporting rural India and will be the part of the program - "Start-up India, Stand-up India". It provides a platform comprising of rental services for agriculture machinery and Implements, audio-visual learning of schemes, technologies and methods, helps farmers in loan products and process & more.

FATE (Farmer's Awareness and Transmission Enterprise)
Increasing farmer's communication with other farmers, sponsors, urban folk, so that they can come together & discuss common problems, irrespective of location; so that solutions can be developed

GreenAccelaration

GreenAcceleration is the solution of a cleaner greener and healthier village by electrifying their lives. It work on an insect free village. our solution to this is a light which repels insect. And the electricity needed for the light to work comes from the road. It makes electricity from the road, and it is one of the cleaner and most ecological way of producing electricity. From this technology it can power the whole village if our product is laid over a stretch of 1 KM.

Gellet
Due to the recent ban on petroleum coke as a fuel, industries are facing a shortage of alternative fuels. They propose converting agricultural waste and manufacturing it into fuel pellets with an innovative business model implemented through a website which acts a bridge between industries and farmer

Irrigate
Physical fragmentation of land is currently a major problem. Farmers own a piece of land where he can cultivate certain crops. Considering we extract a couple of mass buyers or consumers for household purposes, we can bridge this gap between these producers and consumers by giving the land on lease to the consumers where the farmer receives the rent and cultivates certain crops/ provides poultary for the consumers.

MANIPAL UNIVERSITY
JAIPUR

Major Projects Summary Status

Budget Sanction and Expenditure: As on 20th Aug 2023					
Sl. No.	**Projects Description**	**Budget Sanction** (₹ Cr)	**WO Released** (₹ Cr)	**Expenditure** (₹ Cr)	**Major Remarks**
1.	Academic Block-3	₹117.36 Cr	₹114.11 Cr	₹100.32 Cr	100% Work Completed
2.	"Destination Manipal" Experience Theatre	₹12.0 Cr	₹12.55 Cr	₹11.72 Cr	100% Work Completed
3.	Shifting of 132KV HT line by UG Cable	₹6.077 Cr	₹6.077 Cr	₹6.077 Cr	100% Work Completed invoicing pending
4.	MUJ Power Upgradation	₹6.50 Cr	₹3.49 Cr	₹2.14 Cr	Dg and Second Source
5.	Lecture Hall Complex	₹150.0 Cr	₹47.04 Cr	₹16.90 Cr	Substructure work completed 100%, Super structure 25%
6.	Hostel Blocks Girls and Boys	₹430.0 Cr	₹18.19 Cr	₹7.71 Cr	Substructure work completed 80%, Super structure WIP