Mumbai International Airport Ltd.

Progress towards Sustainability & Energy Excellence

25th National Award for Excellence in Energy Management, 2024



Presenters	Moonshots!!					
P Logesh	ACI – ASQ Award - Best Airport over 40 MPPA in Asia Pacific Region [7 th consecutive time]					
DGM – E&M	ACI Asia – Pacific Green Airport Recognition 2023 – Recognized for elimination of single use plastic					
Sri Raghavan S Senior Manager	ACA - ACI Level 4+ Certified Airport. Target: Level 5 by 2025					
	IGBC Platinum Certified, under existing building category					
	Wings India Award – 2024 – Contribution in Operational Excellence					



INTRODUCTION



Key Highlights:

Major Segments: T1 → Domestic T2 → International+ Domestic CA → Corporate Aviation Cargo→ To handle Cargo Operation Airside→ Runway, Apron & Taxiway MLCP→ 2 Multi layer car parking.

- Handled >52 million passengers in FY24
- > India's 1st Airport to Achieve ACI Health Accreditation

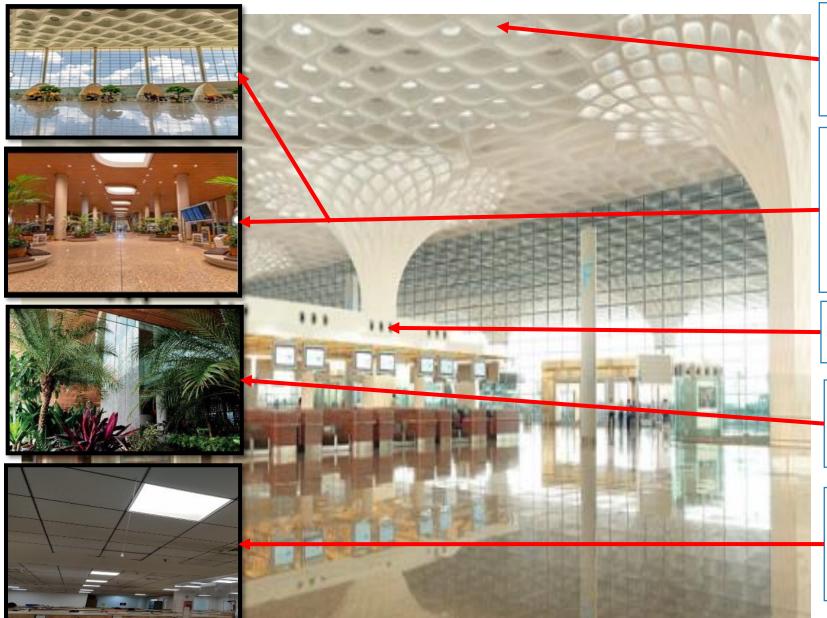
Salient Features



Design of Terminal 2 is inspired from India's national bird – The Peacock 3 Km Multi story art wall with 7000 Pieces of Artwork and Artefacts ATC Tower, tallest in India(Height - 83.2 Mtrs, Built up area is 2800 Sq. Mtrs.)

Design Features





Roof → Energy efficient TPO membrane. It facilitates:

- Resistance to UV
- High reflective property(SR >0.8)
- Ample Day Light harvesting
- **Double glassed façade** to reduce heat ingress.
- SHGC: 0.23
- VLT: 60%
- VAV controlled system across terminal system to optimize HVAC consumption
- Rich landscape of greenery maintained in and across terminal → Reduce heat, upgrades air quality.

Provision of:

- Task lighting in offices
- Occupancy sensors in staircase, MLCP and lesser movement areas

Energy Policy





ENERGY POLICY

In pursuance of Adani group's Vision, mission and core values, Mumbai International Airport Limited (MIAL) shall strive to provide world class airport services and reinvent it as India's biggest aerotropolis, where the traditional airport nucleus of passenger and cargo infrastructure be shall reinforced by interdependent clusters of commercial and residential infrastructure to create the nation's busiest airport ecosystem.

We are committed to achieve such an ecosystem through ESG Strategy keeping in line with our Nation and Group's commitment towards NET Zero.

We are continuously focused on upgrading our systems, processes, procedures and work practices to improve energy performance and to ensure optimum utilization of energy.

MIAL shall achieve the above through the following:

- Comply to all legal and other requirements which apply to its energy use, consumption and efficiency.
- Improve Energy performance with specific focus on Energy Optimization for all facilities, equipment, processes, systems and ensure all equipment and systems run at their optimum efficiency.
- Continuous focus on technology upgradation to improve energy performance.
- Shall support the purchase of energy efficient products, services and design for energy
 performance improvement in all MIAL Operations.
- Creating awareness in energy conservation techniques by imparting training, conducting workshops and seminars for all employees, service providers and stakeholders.
- Ensuring the availability of necessary resources and all information required to achieve objectives, targets and improvement action plans decided on ongoing basis.
- Focus on renewable energy resources wherever feasible.
- Promoting active involvement of all stakeholders to follow best practices so that the energy improvement initiatives are driven to accomplish MAIL's policy on continual basis.

Prakash Tulsiani Chief Executive Officer

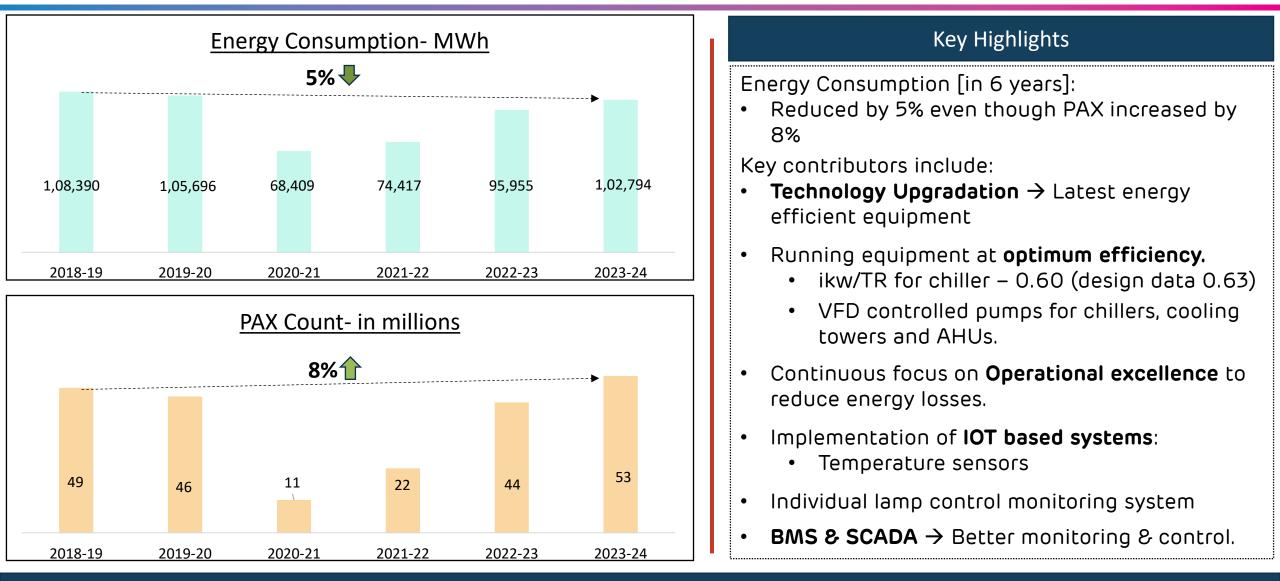
Policy shall be communicated and accomplished at all functions in a structured manner.

Major highlights:

- Focus on energy optimization
- Use of energy efficient products
- Energy conservation awareness
- Using necessary resources to achieve targets
- Focus on Renewable energy
- Active involvements in energy conservation

Energy Consumption





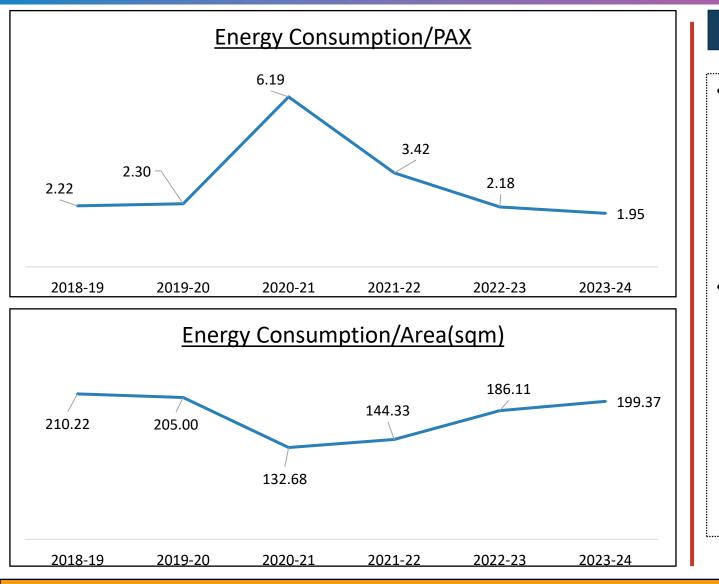
7% increase in Energy Consumption in FY24 vs FY23 :

 Additional chiller run hrs. due to construction work in operational area 2. Higher Ambient temperature

3. Increase in PAX by 20%

Specific Energy Consumption (SEC)





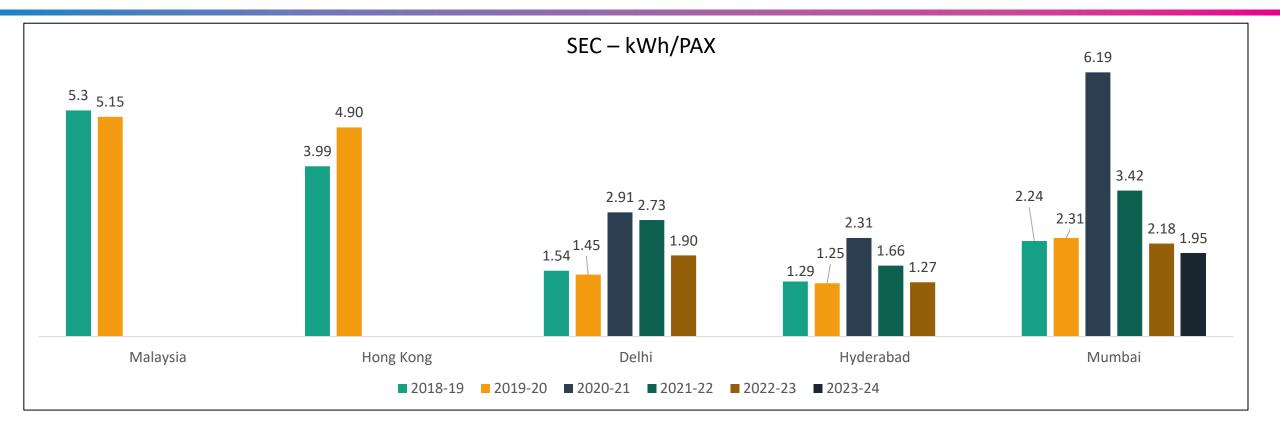
Key Highlights

- Energy Consumption is a mix of Fixed and Variable Load:
 - Fixed load ~40% → Does not depend on PAX
 - Variable load~60% \rightarrow Dependent on PAX
- 7% increase in SEC when calculated in terms of Kwh/sqm is attributed due to:
 - 1. Construction works in Operation area led to:
 - Higher Chiller running hrs.
 - 2. Higher ambient
 - 3. Contribution of Variable load due to increase in PAX

Reduced SEC (Consumption/PAX) by 12% in last 6 years

National & Global Benchmark





Key Factors Affecting Energy Benchmark

- Climatic Zones Mumbai falls in hot & humid zone with little difference in ambient during summer & winter months so limited scope of optimization during winter.
- Building Envelope AHUs in MIAL are mostly centralized(at ground floor) with vertical distribution, providing limited scope to switch off AHUs based on localized area of occupancy

Roadmap | Energy Efficiency via Operational Excellence

Robotic Process Automation

1. Auto Generation of Reports from multiple systems & projecting on dashboards

2. Real time Situational Awareness

3. Key KPIs to support data driven decision making

Comprehensive Energy Management Solution

1. All Electrical assets & Water to be brought under single umbrella.

2. AI/ML based Predictive Analytics with real-time performance monitoring.

Enterprise Alert and Asset Management System

1. Phase 2 of Digitalized maintenance process.

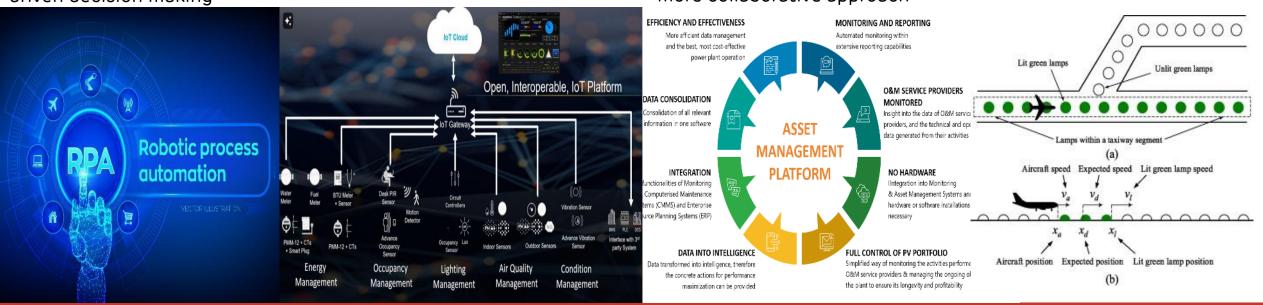
2. Shift from Preventive Maintenance to Predictive Maintenance Process.

3. Shift from Operation in silos to more collaborative approach

Follow The Green

1. Automatic operation of Airside Ground lighting system.

2. Auto Switch On/OFF lights basis Flight movements.



Fueling Energy Efficiency: Uniting Digitalization, Automation, and Cutting-Edge Technology.

Energy conservation Projects, FY 2024-25 (1/2)



Replacement of belt driven fan with EC fan in AHUs[Phase 2]

Project Brief:

- Existing AHU fans have belt driven assembly. It has been proposed to replace the same with direct driven EC fan.
- Project Cost: 6 Cr (For phase-2)
- Pilot Project successfully completed earlier



Execution Plan:

- Project being executed in phase-wise manner.
 - 1st phase 50 AHUs [completed in FY 23-24]
 - 2nd phase 46 AHUs [planned in FY24-25]
- Proposed PDC for 2nd phase Mar'25
- EC fan to be used Rossenburg

Benefits:

- Energy saving : ~ 25%
- Estimated Annual Energy Saving 1.6 million units
- Reduced Maintenance time
- ✤ Lower Maintenance Cost
- Provision of redundancy system
- Additional VFD not required.

Total 3 Energy Saving Projects planned in FY 2024-25 - Estimated Saving ~2 million units

Energy conservation Projects, FY 2024-25 (2/2)



Upgradation of Primary and condenser pumpsmotor assembly with Energy efficient pumps

Problem Area:

- 1. Existing motor is IE-1 [EFF-1] rating and is more than 12 years old.
- 2. Efficiency too low, ~70%
- 3. High maintenance cost and time

Proposed Solution:

- 1. Replacement of all motor assembly with IE-4 set-up.
- 2. Efficiency of the new system >90%
- 3. Reduced maintenance time and cost.
- 4. Improved availability of the system.

Project Details:

- 1. To be executed in 3 phases
- 2. Phase -1 : 4 Pump-motor assembly to be replaced
- 3. Estimated Energy Saving: ~10% [0.2 million units]

IOT based smart street lighting control system for remote bays and perimeter road

Problem Area:

- Remote bays at airside are not 24*7 manned. Every time Manpower needs to visit location to Switch On/OFF lights.
- 2. Leads to Lamps being turned ON for extended period.
- 3. Unserviceable lamps is also difficult to get identified at the right time.

Proposed Solution - IOT Based Lighting:

- 1. Operation of lamps via online application.
- 2. Realtime system health checkup
- Lamps to be Switch On/OFF basis requirements [saving energy losses]
- No of lights to be replaced [Phase-1] 15
- Estimated Annual Energy Saving: 0.01 million units

Synopsis- Energy Saving Projects implemented in last 3 yrs.



Year	No of Energy Saving Projects Implemented	Investments (INR Millions)	Electrical saving (million Kwh)	Thermal savings (Million Kcal/ MTOE)	Impact on SEC-kwh/pax (Electrical, Thermal)
FY 2019-20	3	8.68	0.23	-	0.5% 👢
FY 2020-21	1	2	0.10	-	0.9% 🦊
FY 2021-22	2	14	0.50	-	2.3% 👢
FY 2022-23	3	23.5	0.70	-	1.7% 🖊
FY 2023-24	4	80	2.01	-	3.9% 👢

Each year dedicated Capex budget gets allocated towards Energy Conservation Projects.

(In FY25 – allocated Budget is ~10 Cr)

- Apart from technology up gradation, special focus is also given to operational optimization and digitalization to achieve energy excellence
- Energy Management cell in place to looks after all Energy conservation projects, monitor energy consumption and analyze variances.
- Energy Review meetings with top management on regular basis.

Energy conservation Projects, FY 2023-24 (1/3)

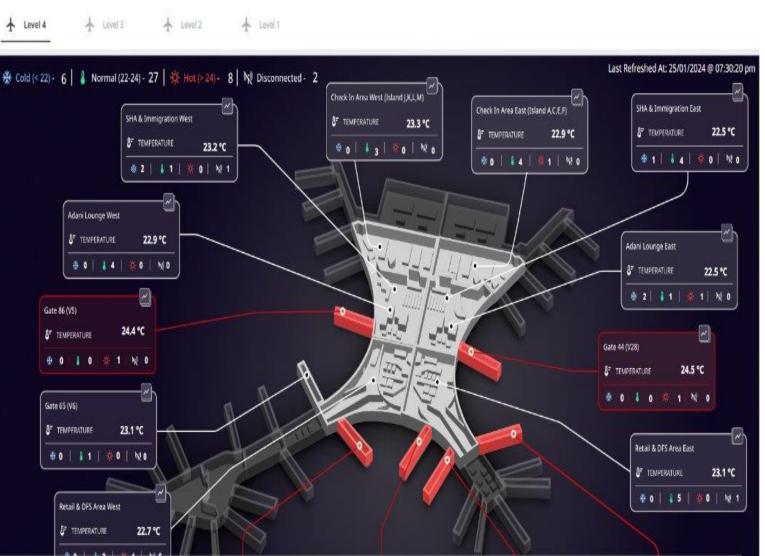


IOT based temperature monitoring & control (Phase-2)

Project Brief:

- Installation of IOT based temperature sensors across terminal building.
- Real-time temperature update.
- All hot and cold pockets can be easily identified, and immediate actions can be taken.
- Provides improved scope for optimization.
- Estimated Energy Saving obtained: 0.1 million units





Energy conservation Projects, FY 2023-24 (2/3)



Replacement of belt driven fan with EC fan in AHUs[Phase 1]

Project Brief:

- Existing AHU fans have belt driven assembly. It has been proposed to replace the same with direct driven EC fan.
- Project Cost: 6 Cr (For phase-1)
- Pilot Project successfully completed earlier

Execution Plan:

- Project being executed in phase-wise manner.
 - 1st phase 50 AHUs [completed in FY 23-24]
- EC fan used Rossenburg

Benefits:

- Energy saving achieved: ~ 26%
- Annual Energy Saving 1.8 million units
- Reduced Maintenance time.

- Lower Maintenance Cost
- Redundancy system
- Removed all VFDs





Energy conservation Projects, FY 2023-24 (3/3)



Conversion of TWY halogen lights to LEDs

Project Brief:

- Replaced existing Halogen taxiway light to LEDs at Taxiways
- Project being executed in phase wise manner.
- Total Project Cost: 2 Cr
- No. of Lamps replaced: 270
- Reduction in Wattage per lamp: 32W
- Annual Energy Saving achieved 0.12 million Kwh



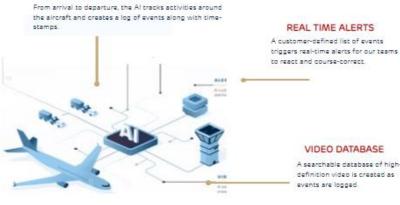
Innovative Project – Smart Apron | India's first AI/ML powered airside operations





Advanced Visual Docking Guidance System[AVDGS]

AI ENABLED TRACK ACTIVITY



Turnaround Management A310 VT108 ALC: NO. **SAE203 JAE20** MGS CHIRD FUELING 457 100.0005 UAE 20. ALC: NO JAE 203 PAX ON M CARGO DOOL AUEL II OL0SED COMPLETED DMPLETER 3.05 ME203 1201 000000 **UAE203** 1.15 10 Jac 203 ACE1 IN FACE ON-BLOCK 17.20 ONINGORED WEST

Operational Impact:

VIDEO DATABASE A searchable database of high-

definition video is created as events are logged

- Real-time Situational Awareness
- Single source of truth for all data across 2. all stakeholders –

Airlines/GHAs/AAI/Airport Operator

- Additional Safety features 3.
- Advanced analytics for operational 4. efficiency
- **Resource** Optimization 5.

Environmental Impact:

Occurrent 1000

1000

Turnaround Manager

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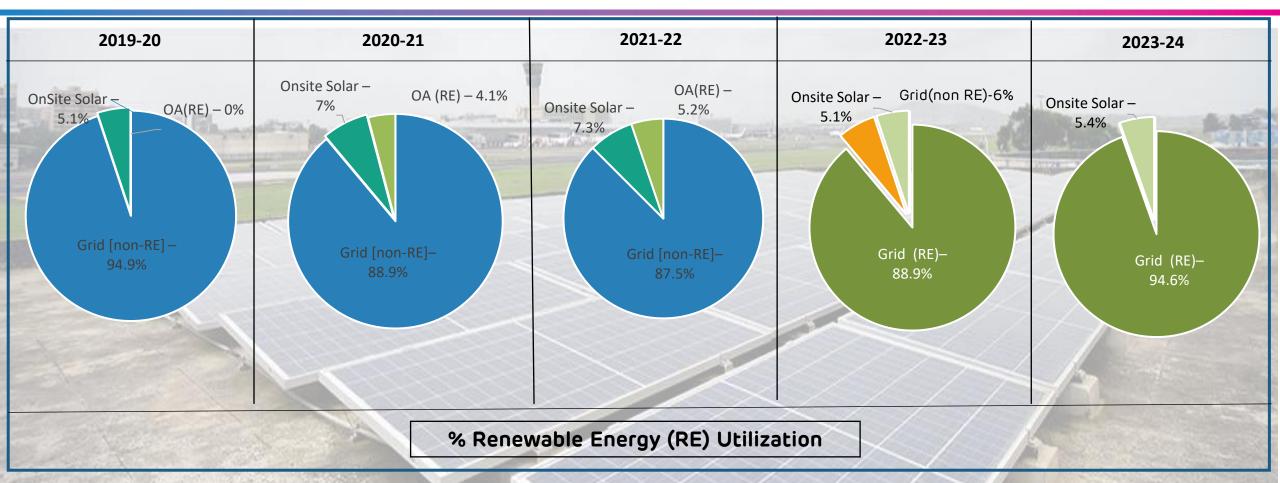
STORY DRAW

2 minute of faster turnaround will contribute to:

- ~3.16 kg of Co2 emission reduction per flight.
- ~ 5 lakhs kg of Co2 emission saving per vear
- ~ 10 lakh units of Energy Saving per year

Utilization of Renewable Energy Sources



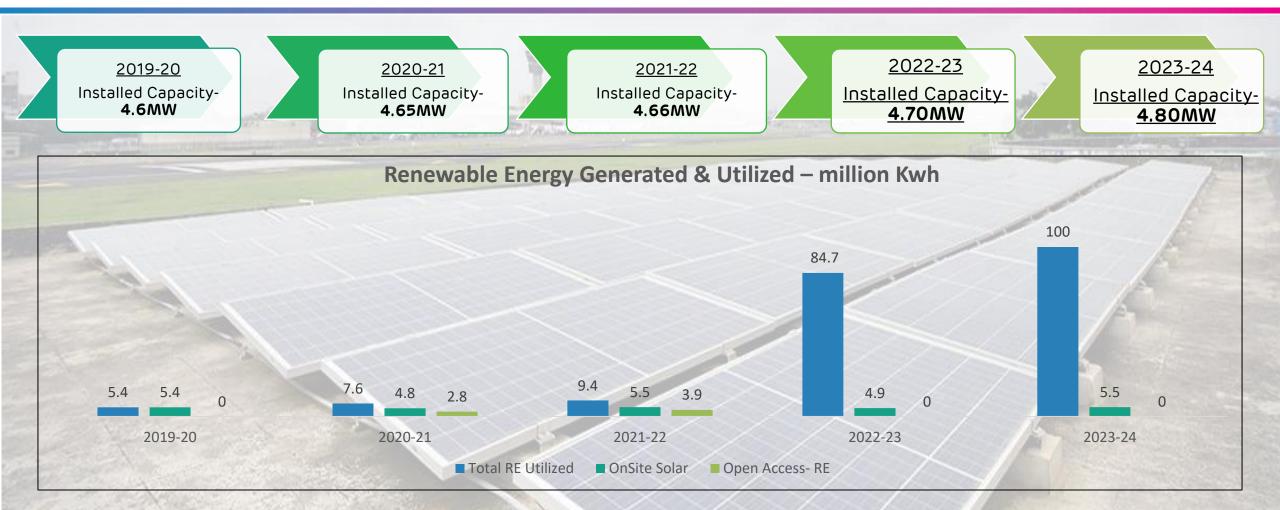


Inspite of severe space constraint, MIAL has continuously strived to increase its RE share via be it onsite/Open Access/RE purchase

MIAL is the 1st Airport in India to install VAWT – A hybrid RE technology to harness both solar & wind energy. 24*7 RE generation solution. Current Installed capacity of VAWT – 120kwp

Utilization of Renewable Energy Sources



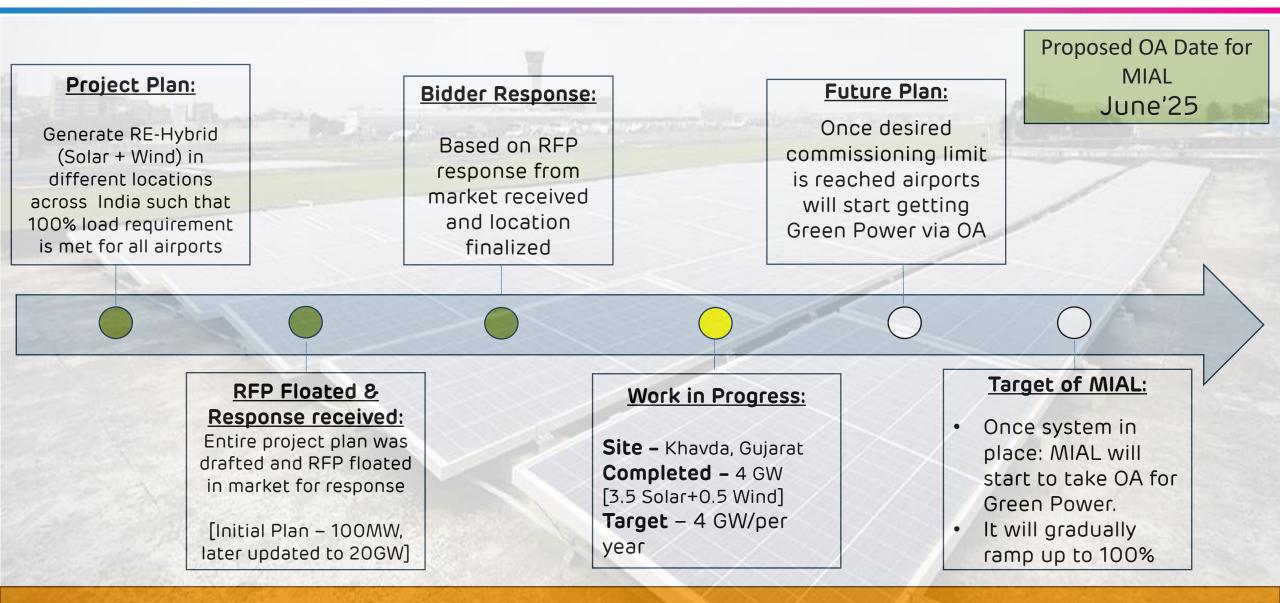


MIAL is incurring additional cost of Rs. 0.80/unit to procure 100% green power.

MIAL runs on 100% Green Power.

Offsite Solar Generation Project ~ 20 GW





Group has planned to GENERATE & UTILISE 100% GREEN power for all its airport across India

GHG Emissions



Sources of Green House Gas Emission							
<u>Type</u>	Activities	Remarks					
Scope-1	Fossil fuel, Fire Extinguishers, Refrigerant	Directly under control					
Scope-2	Electricity	Directly under control					
Scope-3	Stakeholder electricity, stakeholder fuel, LTO-Arrival/de passenger/staff/business travel, Offsite emissions	eparture, 3 rd party dependent – Can only suggest and influence					
	GHG Emission- tCo2 535225 383607 410358 176152 180508 55770 59844 1179 2019-20 2020-21 2021-22 2022-23 2023-24	Specific GHG Emission (kgCo2/Pax)					
	■ Scope-1 ■ Scope-2 ■ Scope-3	2018-19 2019-20 2020-21 2021-22 2022-23 2023-24					

- MIAL has successfully achieved zero Scope 2 emissions.
- Increase in Specific GHG Emission is due to increase in Scope-3 emission → Result of greater no of flights handled.

Measures taken to reduce GHG emission



食	Green Power	100% green power– Scope 2 - emission reduction by 85k tCo2				
		Self generate 100% renewable power for Mumbai Airport by 2025				
¥	Transition to Lower GWP refrigerant	All equipment with high GWP refrigerant being replaced with low GWP refrigerant – Scope-1 emission reduction by >40%				
	EV Vehicles	Conversion of conventional fuels vehicles to EVs – in phase-wise manner In FY2022-23 → 45 vehicles replaced In FY2023-24 → 6 vehicles replaced				
1	Non-CO2 based fire extinguisher	All CO2 based fire extinguisher have been converted to non-CO2 based fire extinguishers				
	EV Charging Station	 Move to encourage EV vehicles across CSMIA - 7 EV charging stations installed [2022-23] 40 EV charging stations installed [2023-24] 				



Indoor Air Quality



MIAL strives to maintain healthy indoor air Quality.

- **3**rd party air quality check is done at regular intervals.
- Co2 sensors installed in return ducts of all AHUs & automatic fresh air intake when value crosses set parameters.
- Portable Co2 meters used to check Co2 level in all offices & crowdy areas multiple times in a day
- In FY2022-23, UV lamps being installed in all AHUs to upgrade the quality of indoor air.



esting Laboratory is certified by ISO 9001:2015 & ISO 45001-2015 Recognized by MoEFCC as "Environmental Laboratory" valid up to 24.04.2024 Laboratory: P-1, MIDC Mohopada, P.O. Rasayani, Dist. Raigad Pin 410222 Tel: 02192 252008, CIN: U74999MH2001PTC132091 UDYAM-MH-19-0029787

Ref. No: AESPL/LAB/WP-24/02/57-72

Test Report (Indoor Air Quality)

Issue Date: 06/03/2024 Indoor Environment Quality Standard, ISHRAE 10001:2016

Sr. No.	Parameter with unit	IGBC Threshold values Class B (Acceptable)						
	Parameter with unit							
1.	SO ₂ , μg/m ³	$< 80 \mu g/m^3$						
2.	NO ₂ , µg/m ³ < 80 µg/m ³							
3.	CO ₂ , ppm	Max. 440 ppm above ambient						
4.	4. CO, ppm < 6 ppm							
5.	O ₃ , μg/m ³	< 75 µg/m ³						
6.	TVOCs, µg/m ³	< 650 µg/m ³						
7.	- PM ₁₀ , μg/m ³ < 75 μg/m ³							
8.	PM _{2.5} , μg/m ³	$< 20 \mu g/m^3$						
9.	Temperature, °C	24.5 ± 2.5 - Limits as per ISHRAE 10001:2016						
10.	Relative Humidity, %	30% - 70% - Limits as per ISHRAE 10001:2016						
11.	Air Velocity, m/s	< 0.2 m/s - Limits as per ISHRAE 10001:2016						
12.	Total Microbial Count, cfu/m ³	150 cfu/m ³						

Conformity Statement: The monitoring undertaken indicates that Indoor Air for monitored parameters are within the levels stipulated under Indoor Environment Quality Standard, ISHRAE 10001:2016 for Class B.

Sample Air Quality report – Inspection by 3rd party





Rich landscape of Greenery is

maintained inside terminal which further upgrades the air quality & gives a feelgood attitude to all stakeholder

Waste Management











Proper Waste Management SOP in place – being strictly followed for managing wastes. Inhouse Organic Waste Convertor (OWC) of 1.5 MT/day - to make organic

compost



Target- Zero Landfill waste by channelizing all waste for reuse & recycle. Replaced conventional chemicals by Super Concentrated green chemical (93% chemical volume reduced) Reduced →plastic waste @78% p.a. & Cardboard @ 72% p.a.



Commissioned

dedicated

Common

Hazardous

Waste

Storage

Facility- 2021

for Hazardous

Waste

Management for

all CSMIA

stakeholders.

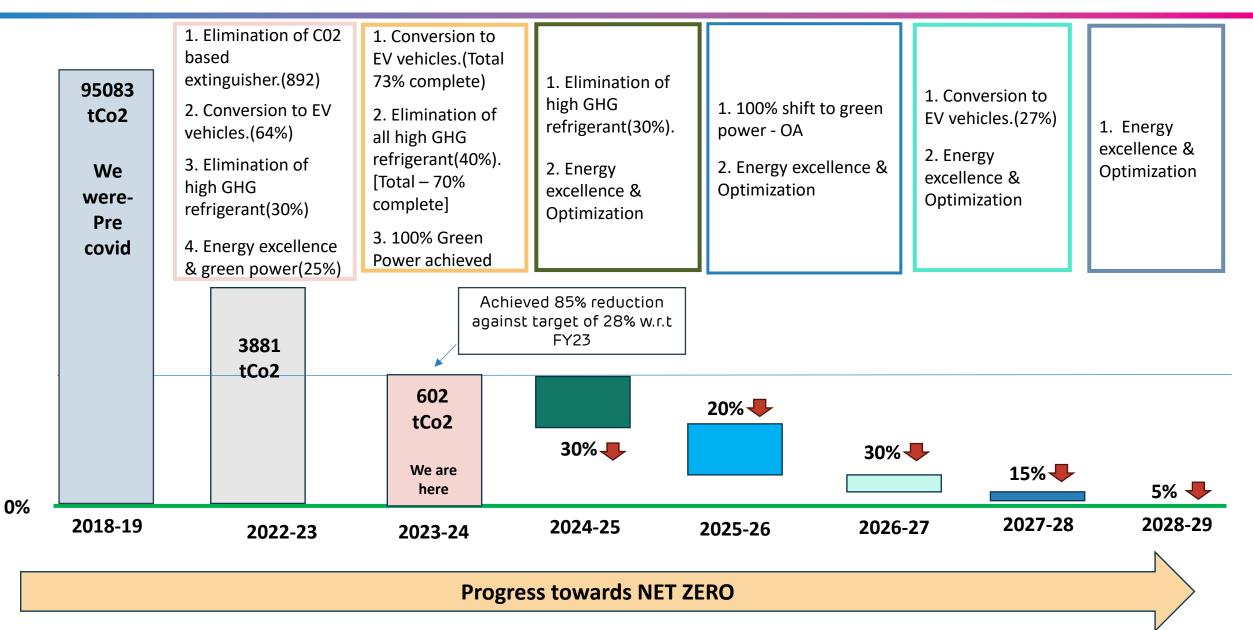


Sewage treatment plants (STPs) a cumulative capacity of 15 MLD is installed for waste water treatment.

Target – ZLD by 2025

NET ZERO Road Map





Monitoring System – BMS & SCADA



SCAD	DA Ger	nerate	d - Da	ily Mo	nitoring	Report	DAY WISE DEVIATION DETAILS										
DATE	BHS	PBB	HVAC	MAIN FIRE STATION	LIGHTING	POWER DISTRIBUTION	MACHINE ROOM PANEL	PUMP PANEL	RETAIL & TENANT PANELS	UPS	UTILITY AUX.CONSUMPTION	MLCP	STP	Chiller	TRITURATOR BUILDING	CCR1	High Mast Light
17-Aug-24	10842	4763	45240	893	31861	17777	3525	1082	35992	19580	1086	33900	2840	119056	29	3300	157
18-Aug-24	10764	4632	45782	808	32039	17464	3613	1072	36117	19583	1092	33500	2490	124722	31	3600	161
Variance	-78	-131	542	-85	178	-314	89	-10	126	3	5	-400	-350	5666	2	300	4
Variance %	-0.72%	-2.75%	1.20%	-9.52%	0.56%	-1.76%	2.52%	-0.92%	0.35%	0.02%	0.48%	-1.18%	-12.32%	4.76%	6.90%	9.09%	2.23%

Services	Cumulative Energy Consumption (KWH) Till Date (AUG-2024)	Consumption in %		
BHS	195563	3.09%		
BRIDGE JUNCTION BOARD(PBB)	75049	1.19%		
HVAC-LS	801351	12.67%		
MAIN FIRE STATION	15099	0.24%		
LIGHTING DISTRIBUTION PANEL	588838	9.31%		
POWER DISTRIBUTION PANEL	328127	5.19%		
MACHINE ROOM PANELS(VHT)	64024	1.01%		
PUMP PANELS	20291	0.32%		
RETAIL & TENANT PANELS	647579	10.24%		
UPS PANELS	352032	5.56%		
MLCP-HT PANEL	600000	9.48%		
STP	48790	0.77%		

Section-wise Consumption Report



Refurbished BMS room with advanced technology

- ✓ SCADA & BMS for 24*7 real time monitoring, Operation and Control.
- Daily section wise Consumption reports
- Regular review meetings, being chaired by HOD, on consumption and progress tracking.
- Energy a key topic of MRM being conducted by top management – Chief Airport Officer

EnMS & IGBC Certification



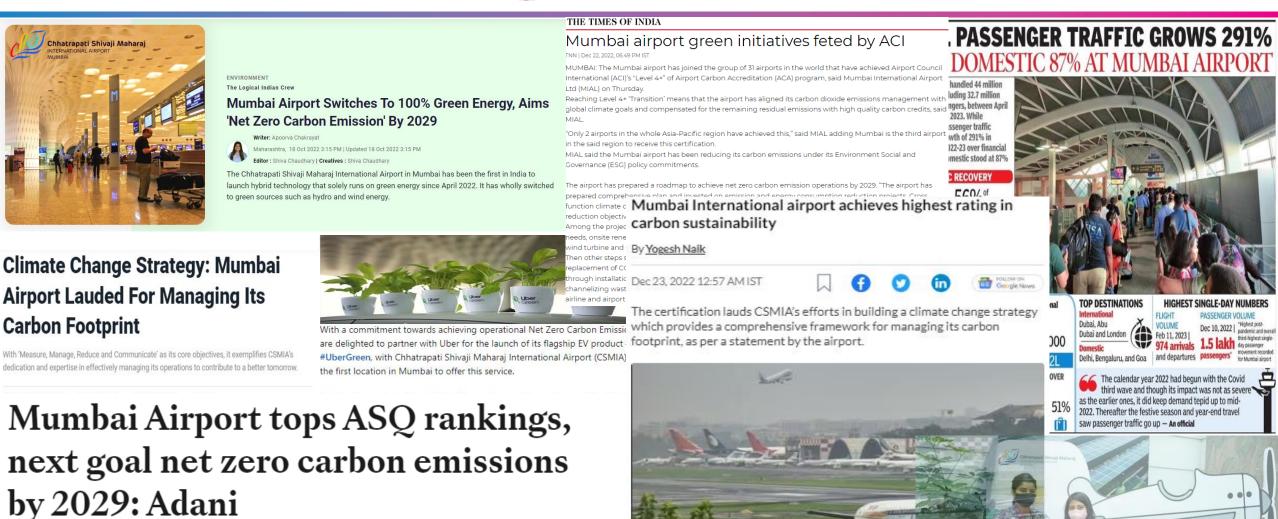


- Providing a National platform to showcase efforts & getting recognized for the same indeed acts as huge motivation to act & perform better.
- * Opportunity to see other's performance & where we stand \rightarrow Forum helps in getting additional ideas from others.
- Multiple companies showcase their energy efficient products → Exposure to new available products in the market.

Print & Social Media Coverage



bai International Airport Spreads the Message of Green Living With Travellers on World Environmer



Emission by 2029. (PTI)

CSMIA has prepared a roadmap to achieve Green House Gas reduction (Carbón Management) CSMIA has prepared a roadmap to achieve operations Net Zero Carbon

Mumbai Airport has achieved the distinction of being the best in the Asia Pacific region for services, as per the Airport Service Quality (ASQ) rankings, announced Gautam Adani, Chairman of AdGroup which runs Mumbai's Chhatrapati Shivaji Maharaj International Airport (CSMIA).

Awards & Accolades







Chhatrapati Shivaji Maharaj International Airport



CII Green CO "GOLD" rated company



Greenest Building



Thank You

Email: <u>ssri.raghavan@adani.com</u> Contact: 9003114362



<u>https://iosense.io/io-lens/view?id=65f4207ae902b3765462103a&v=2&UE58.06606339153</u>
 <u>4286=1</u>