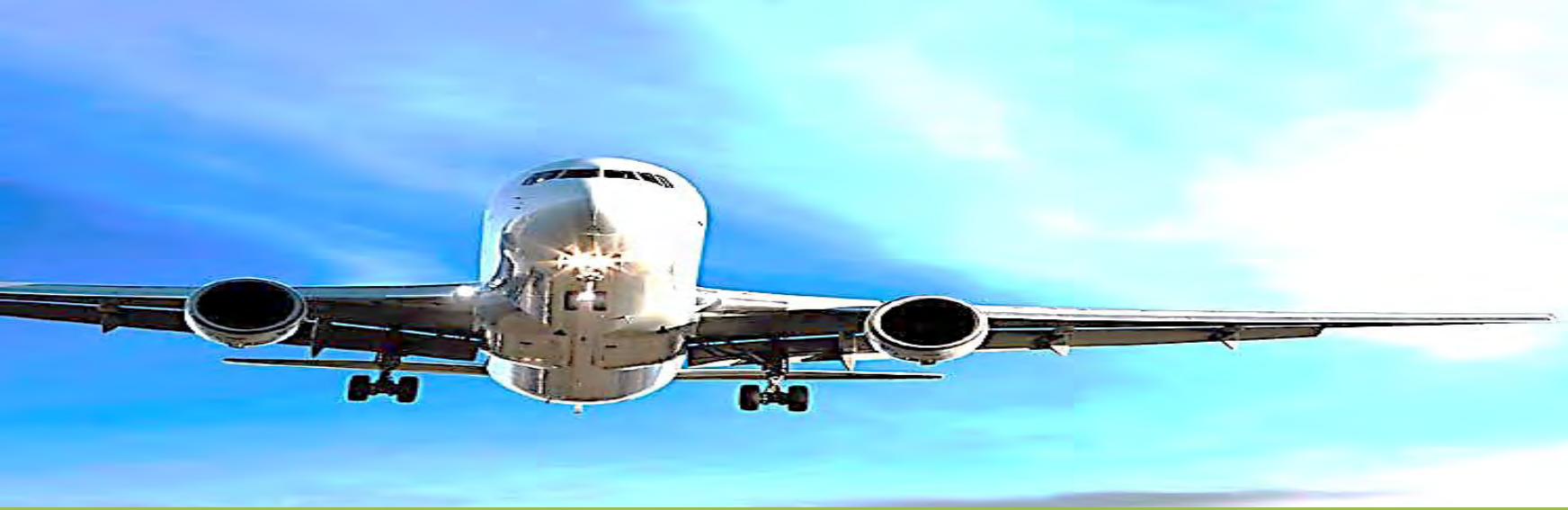


GREEN Airports – Features and Perspectives

Shireen Jkassim, PhD, LEED AP, QSAS, IESNA, CIBSE (Affiliate),
International Islamic University Malaysia

Zainuddin Hussien
Managing Director,
EAG Consulting Sdn Bhd Malaysia

CharacteristicsOf Airports

Characteristics of airport as building type:

1. Categories depend of passenger movement and flight movement per year , generally split into 3 broad categories:

    i. International
    ii. Regional
    iii. Local

2. International airports are large structures with large gross floor area, 24 hour services, high flight movement and services, almost like mini cities

3. Airport have both static transient occupant load due to high passenger and visitor movement

4. Airport have both landside and airside activities and services

CharacteristicsOf Airports

Airport Passenger Movement

Airport	Annual Enplanement (taken from rep year)	GFA (m^2)
Kota Kinabalu	5,112,577	117,463
Kuching	3,627,671	45,900
Penang	3,103,772	28,596
KLIA	24,129,748	406,444
LCCT	15,300,300	150,000

Examples - Green Airports

Austin Bergstrom Airport

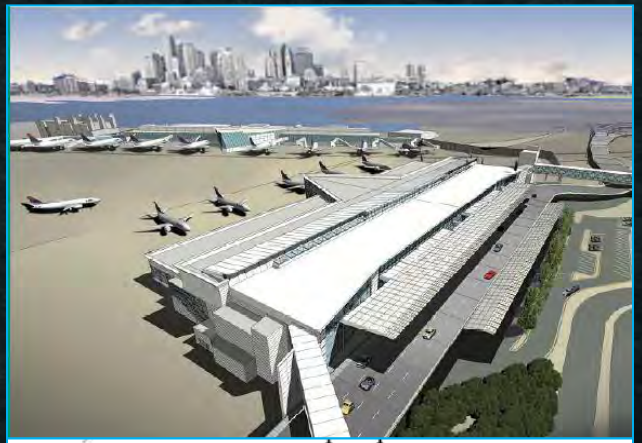
•Orientation of the building and glass façade

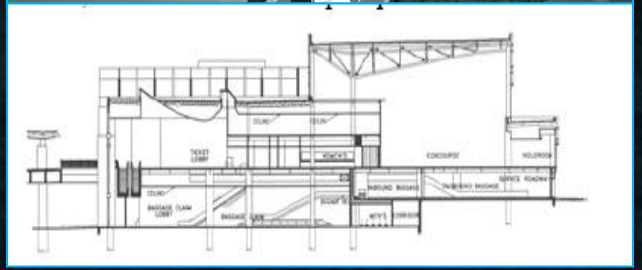
•Even during cloudy days, ample quantities of daylight illumination were seen adequately distributed into the internal spaces.

•Due to passengers' movement and short duration of occupancy in the space, they could adjust well towards direct sunlight, irregularities in lighting and varying light levels, as well as comfort irregularities.

• integration of premium building insulation, light fixtures that automatically adjust for day-lighting, efficient lights and lamps, high efficiency boilers and chillers and heating and cooling system that use primary-secondary piping.

•Its energy-efficiency features had led this airport to exceed IES energy lighting power limits by 15% and ASHRAE energy requirements by 11%.





Examples Of Airports

Boston Logan Airport

•With notable features like heat-reflecting roof and windows, low-flow faucets and waterless urinals, self-dimming lights, and storm water filtration, Boston Logan Airport's new Terminal A has become the first airport to be LEED certified.

•Terminal A features a roofing membrane and paving designed to reflect heat from the building and special stormwater filtration devices to remove suspended solids and total phosphorous.

•water-efficient plumbing and irrigation; extensive daylighting and high-insulation glass; energy-efficient electric lighting; construction waste recycling; and the use of recycled, local materials.

•Adhesives, sealants, paints and carpets were specified to have very limited or no volatile organic compounds.

Examples - green Airports

Indianapolis Airport

•The heart of the terminal will be a 43,000ft² circular central plaza with a 100ft diameter skylight, to make use of natural illumination and give a feeling of openness.

•recycling and re-use opportunities; and lessen the new airport's overall environmental impact, both during construction and subsequent operation.

•The arched form of the roof structure is designed to promote natural cooling by harnessing the laminar airflow over its surfaces. The roof surface will also reflect energy, limit heat gain and channel rainwater for collection and use in building services. The building structure also incorporates light wells to channel natural sunlight from the roof to the first floor.

Examples - green Airports

Indianapolis Airport

A variety of environmentally friendly features contribute towards LEED certification

•A roofing membrane that is star rated for energy efficiency will be used

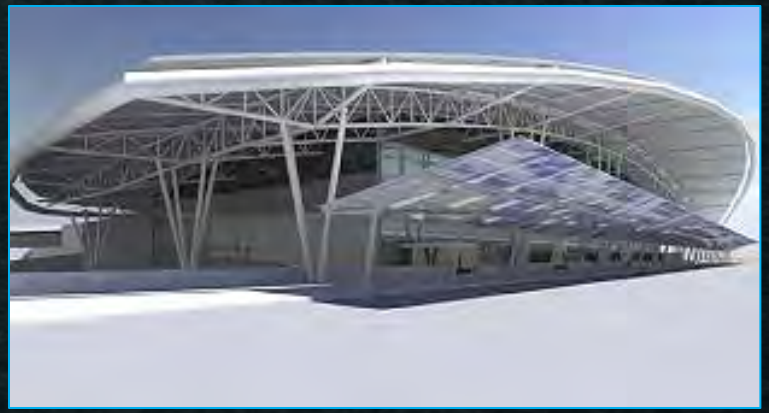
•local materials wherever possible

•Light fixtures with shielded and directed light – which reduces light pollution – will be used

•Infrared switches on bathroom and toilet fixtures will be used, as well as high-efficiency toilet fixtures to reduce water consumption

•Construction waste management carefully controlled, and old asphalt and concrete reused as back-fill in other areas of the project

•The timber used in construction will be obtained from Forest Stewardship Council environmentally managed and sustainable forests



CharacteristicsOf Airports

Indianapolis Airport

•Airport vehicles will be powered by electric motors wherever possible or using clean-burning fuels

•An energy-efficient underfloor heating / cooling system will be used in the plaza and adjacent spaces

•The high ceiling space of the terminal will have a conventional air volume HVAC system employing stratification principles to conserve energy

•High-performance glazing with ceramic frits will be used to reduce interior glare and solar heat build-up in the concourses

•Locations will be provided for the storage and collection of recyclable materials

•A two-tiered glycol recovery system will be used for the separate collection of high- and low-concentrated storm water run-off. Glycol and wastewater will be recycled

•Sealants, coatings, paints and carpet systems with low levels of volatile organic compound will be used to reduce allergic reactions and odors

CharacteristicsOf Airports

Hyderabad International Airport

•savings (25% in energy and 30% water) has inculcated a discipline within the organization to preserve the environment. RGIA is one of the few airports in the world to achieve green status.

•The airport reuses 100% of the treated wastewater generated in the site for landscaping, air conditioning make up water and flushing requirements.

•with good day lighting which helps in the reduction of lighting energy consumption.

•Energy efficiency is achieved by a host of measures like the use of high performance glass with excellent thermal properties, high efficiency chillers, insulated walls and roof and variable frequency drives for the pumps.

•In addition, the application of skylight and fenestration strategy with integration of high performance glass, which allows daylight and to achieve energy efficiency, together with high efficacy chillers, insulated wall minimizes internal heat gain in maintaining overall comfort condition.

CharacteristicsOf Airports

Hyderabad International Airport

•The RGIA is one of the few airports where the indoor air quality is monitored on a real-time basis. The differential CO2 levels at any point of time is maintained at levels below 530 ppm.

Some of the green features of airport include:

•Conservation of top soil

•Electric charging refueling stations in the parking lots

•100% Rain water harvesting100% Grey water treatment

•23% reduction in energy consumption as against ASHRAE baseline

•Use of efficient chillers, lighting controls and a lighting power density of 0.9 watt/ sq. ft

•as against a norm of 1.3 watt/ sq.ft

•Use of materials with high recycled content

•Fresh air purging to maintain good indoor air quality

•Use of green house-keeping chemicals

Example – Green Airports

Indira Gandhi International Airport

Terminal 3 earned a 'Leadership in Energy and Environmental Design New Construction' (LEED NC) gold rating.

capacity to handle up to 34 million passengers a year. The terminal was completed in time for the 2010 Commonwealth Games held in New Delhi. Here are some of the features that earned the terminal the rating:

•Storm water drains were constructed to control erosion and sedimentation

•Parking facility has 215 electric charging stations

•Water supply for landscaping is supplied by recycled water from the sewage treatment plant

•Radar sensors that control lifts and escalators 1,200 energy-efficient LCD screens are used to display passenger information

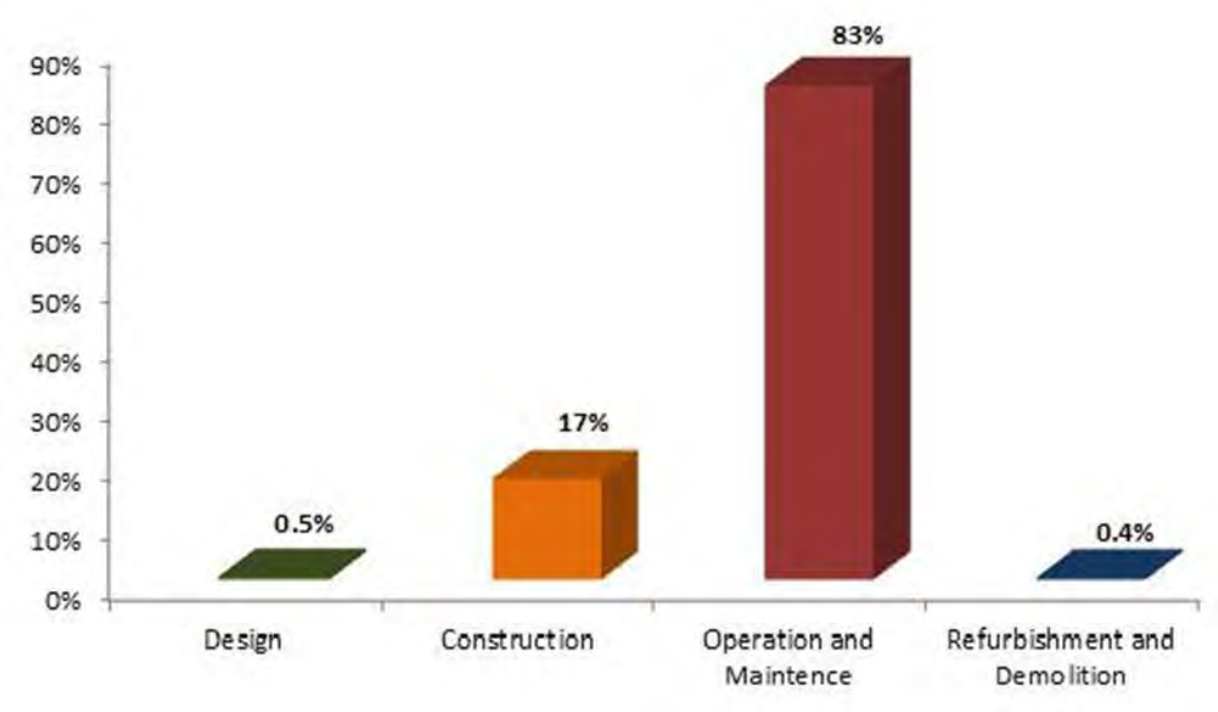
•More than 95% of the construction waste was sold for recycling

•100% of the departure level is lit by natural light during the day

•All housekeeping chemicals are eco-friendly and biodegradable

•300 rainwater harvesting stations, up from 50 in 2008.

Breakdown Carbon emission – Building Life cycle

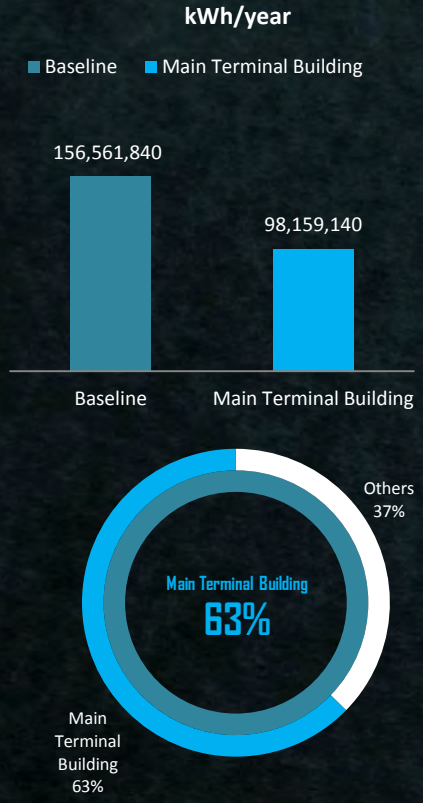


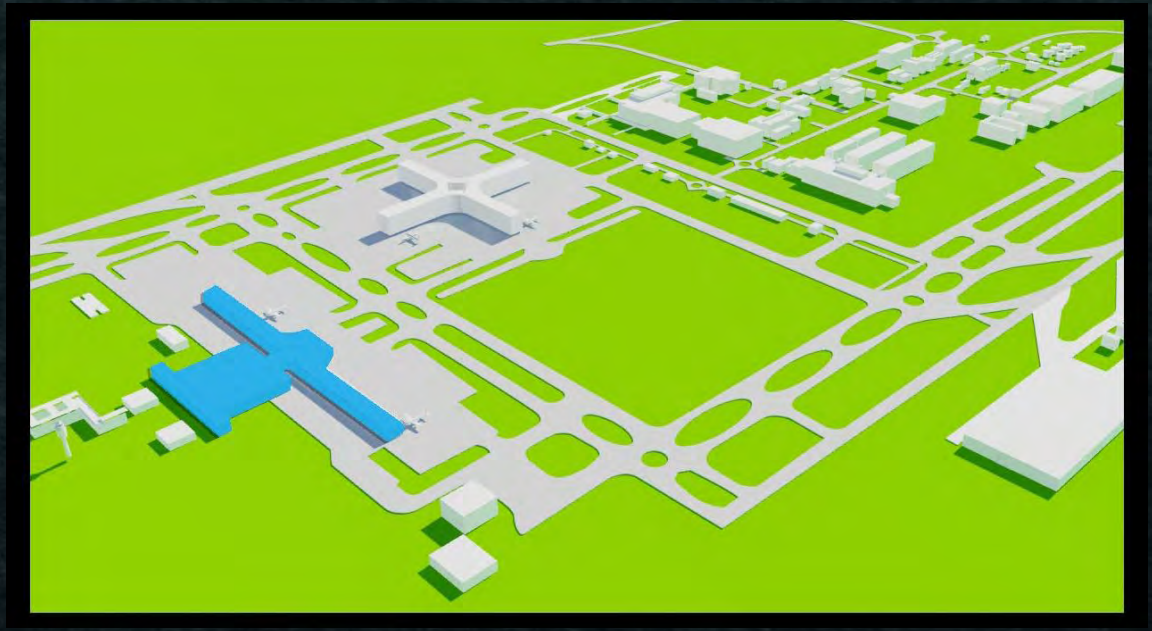
Airport masterplan – Comparative CarbonEmission

Percentage breakdown %

EnergyConsumption

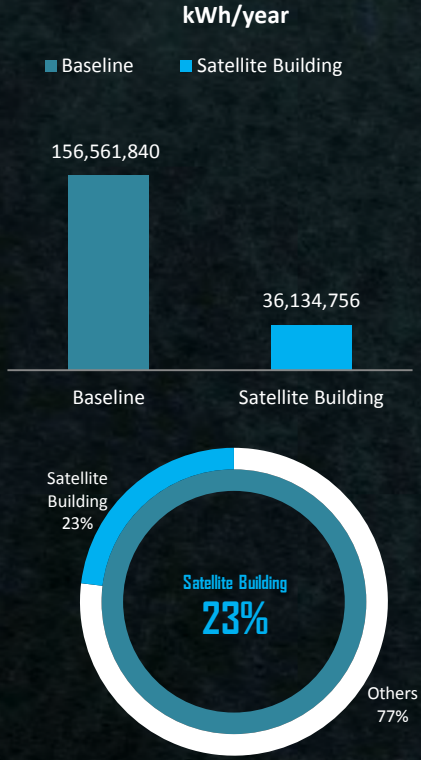
Main Terminal Building

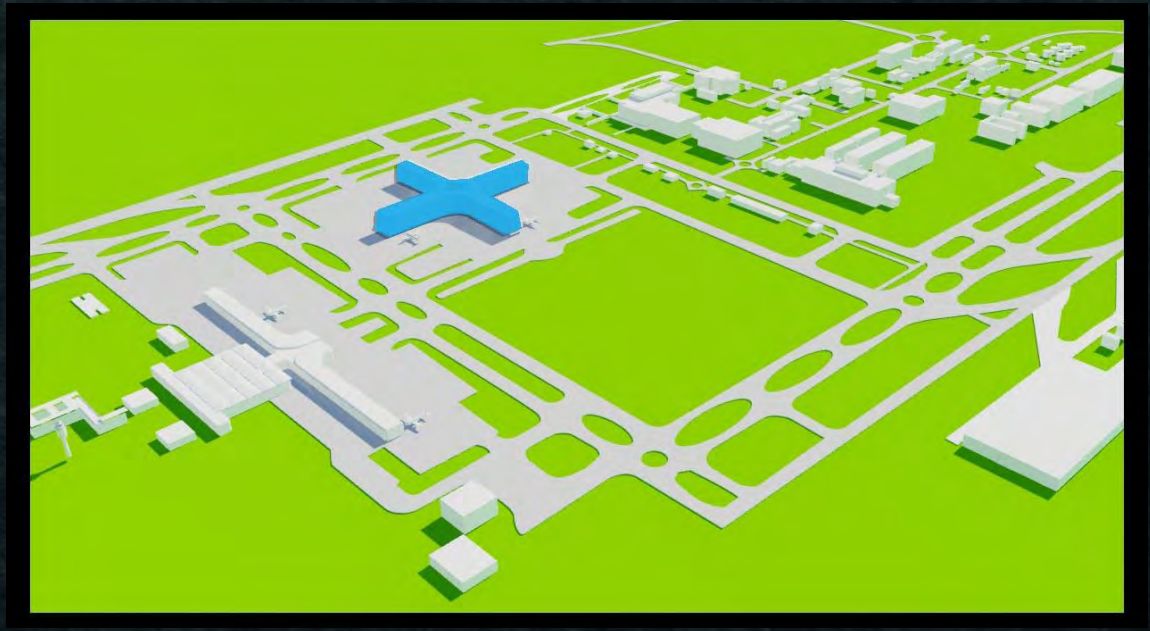




EnergyConsumption

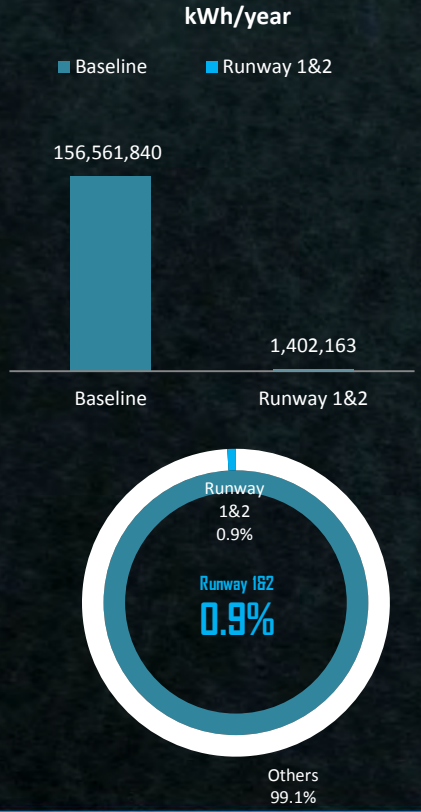
Satellite Building

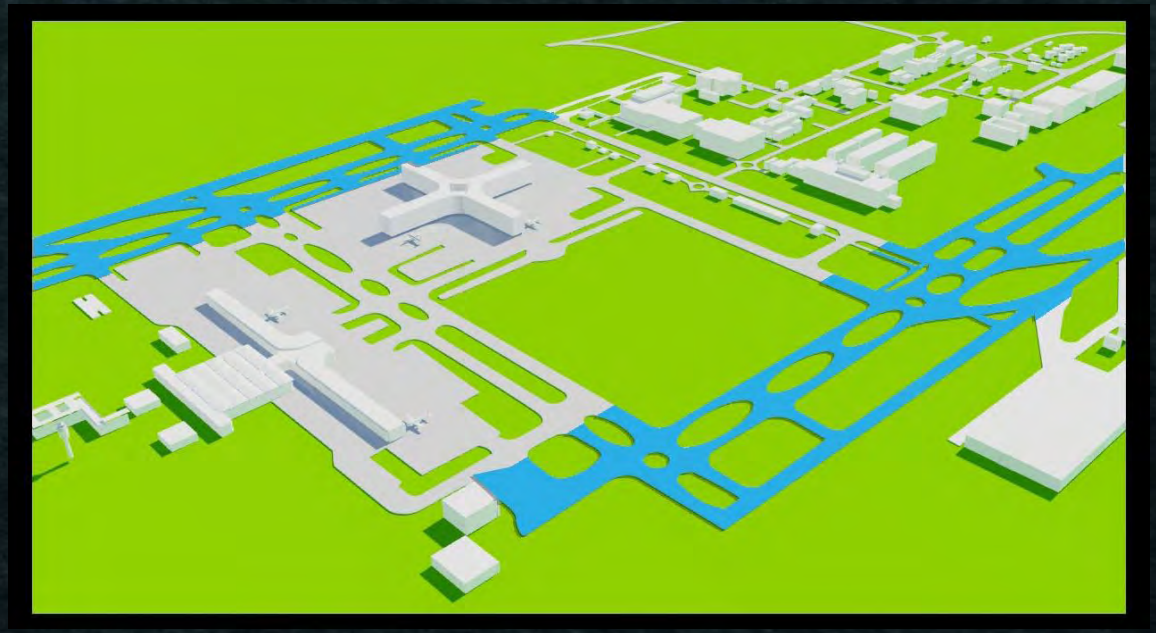




EnergyConsumption

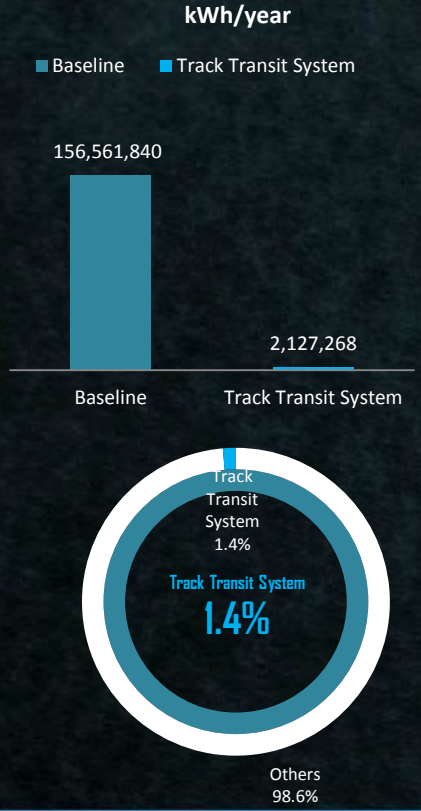
Runway 1&2

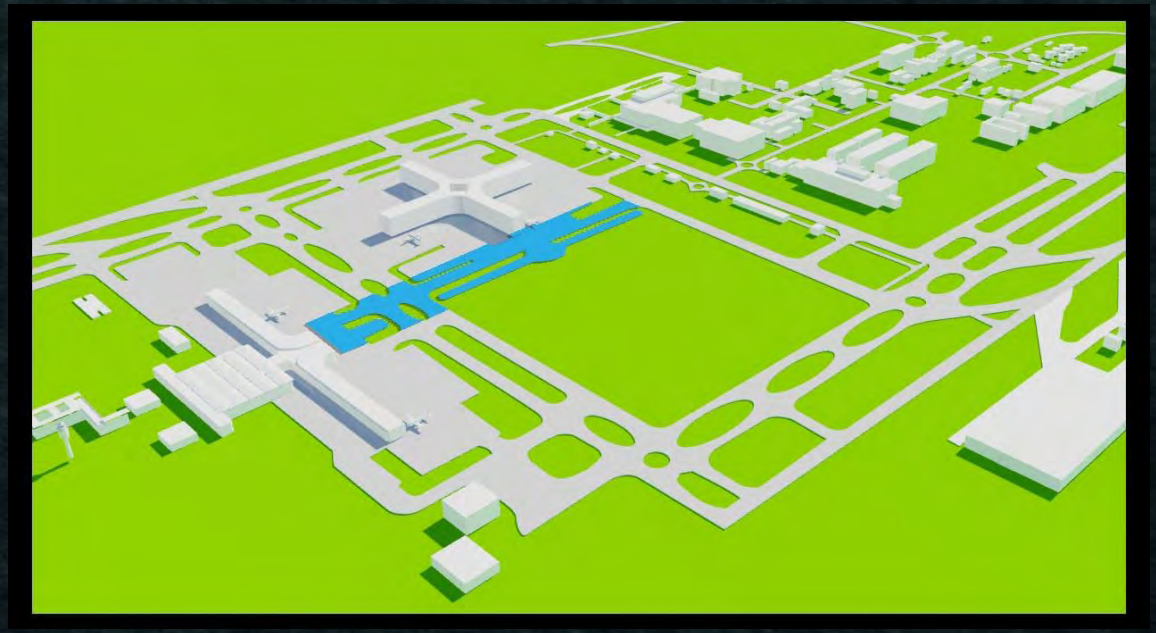




EnergyConsumption

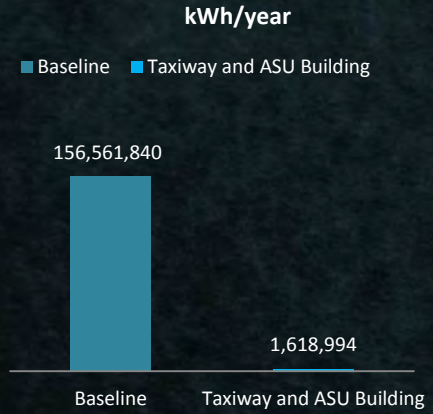
Track Transit System

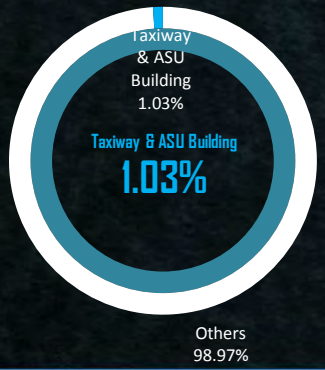


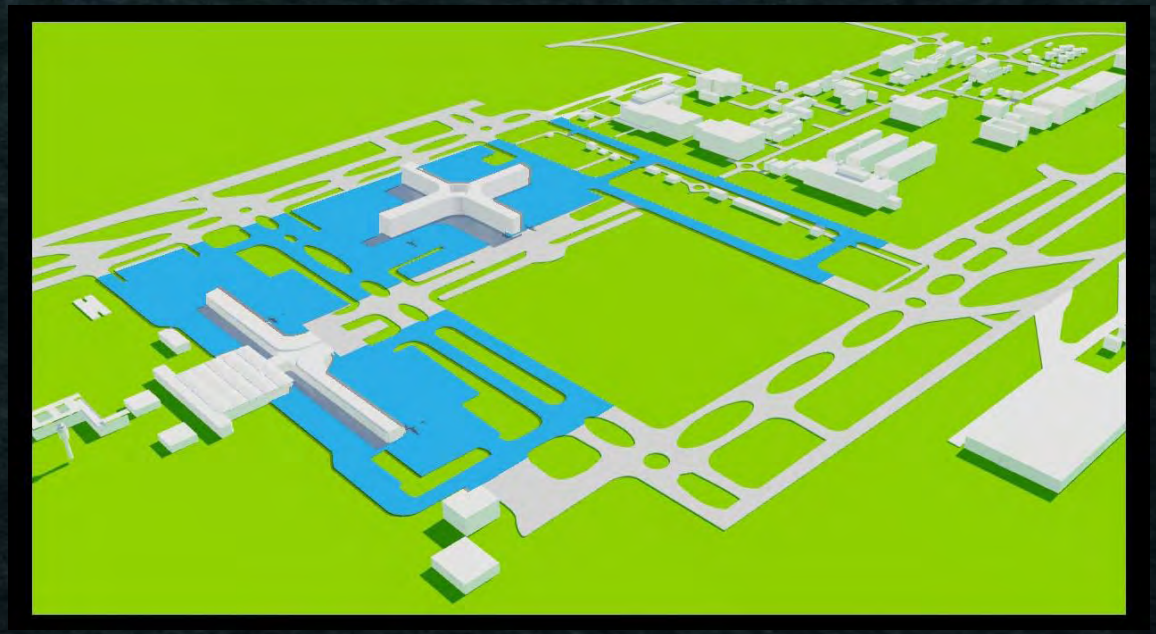


EnergyConsumption

Taxiway and ASU Building

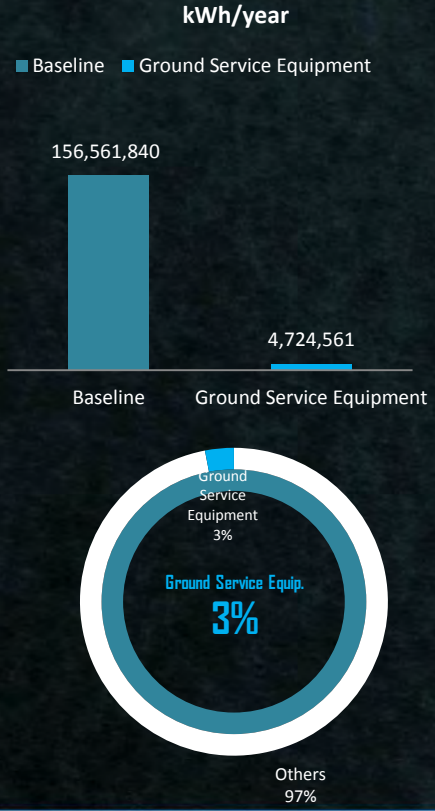


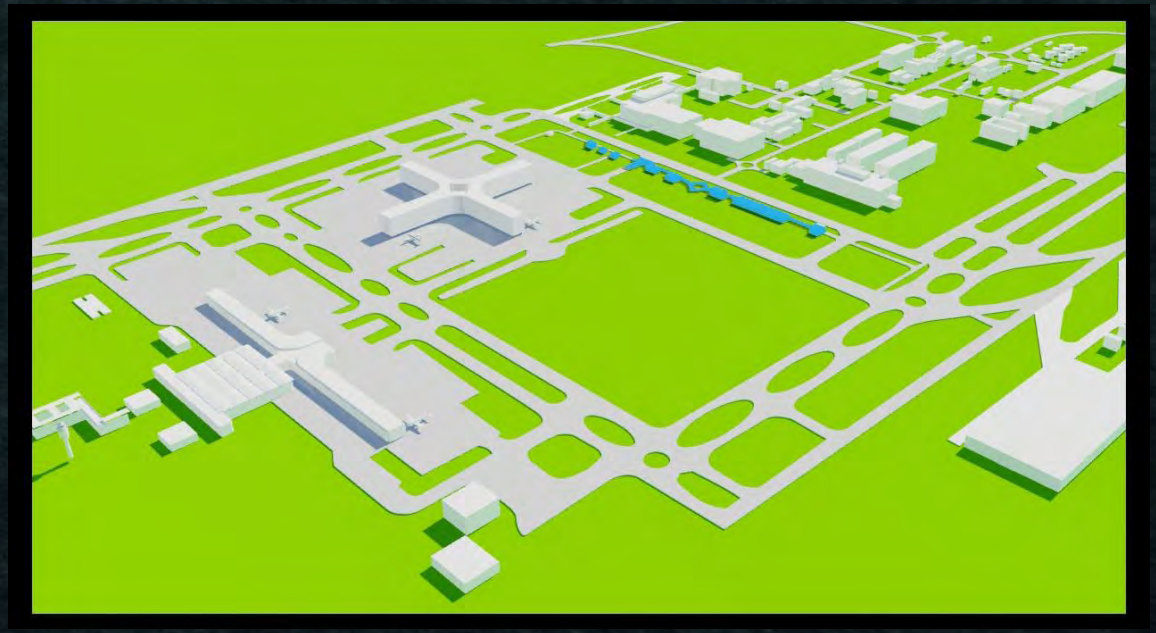




EnergyConsumption

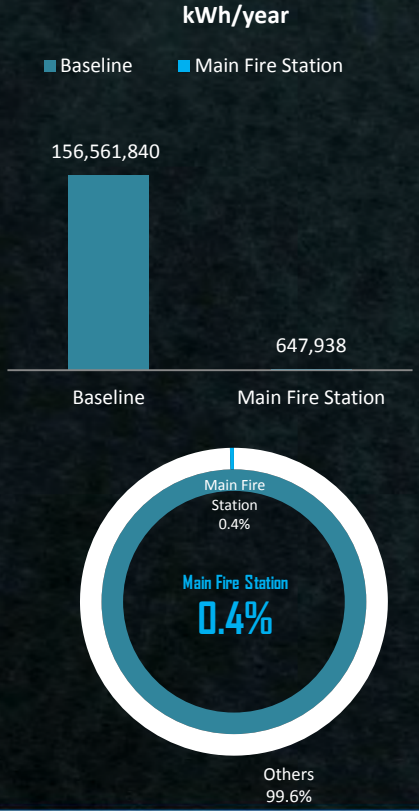
Ground Service Equipment

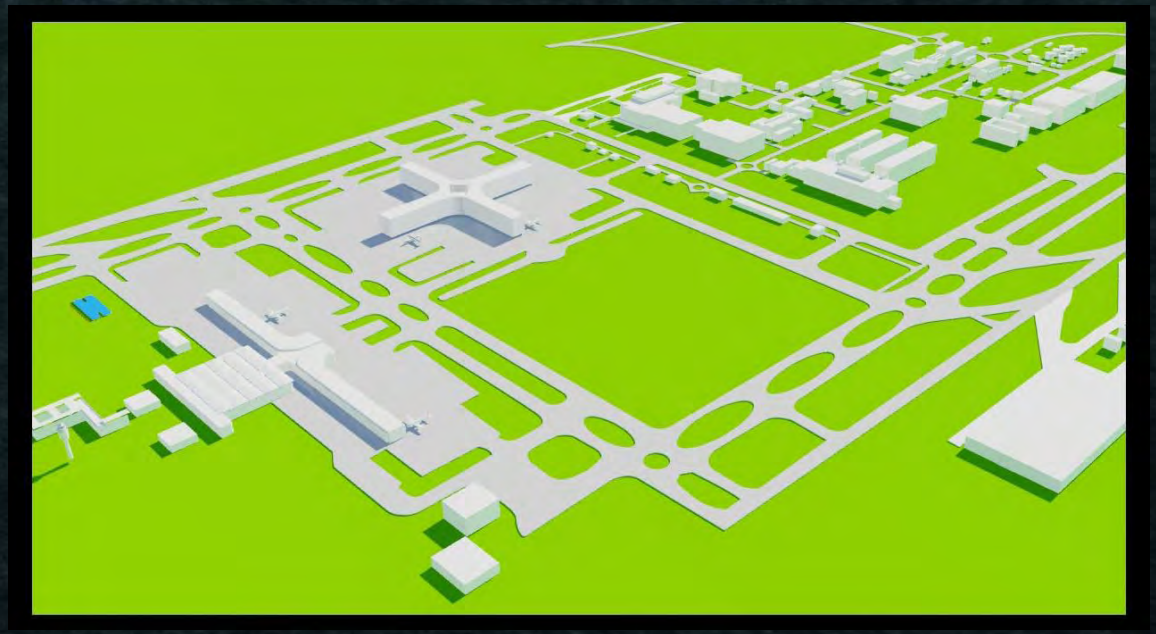




EnergyConsumption

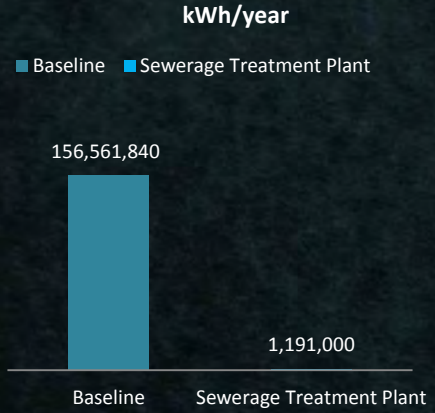
Main Fire Station

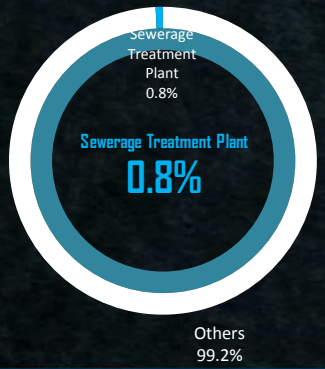


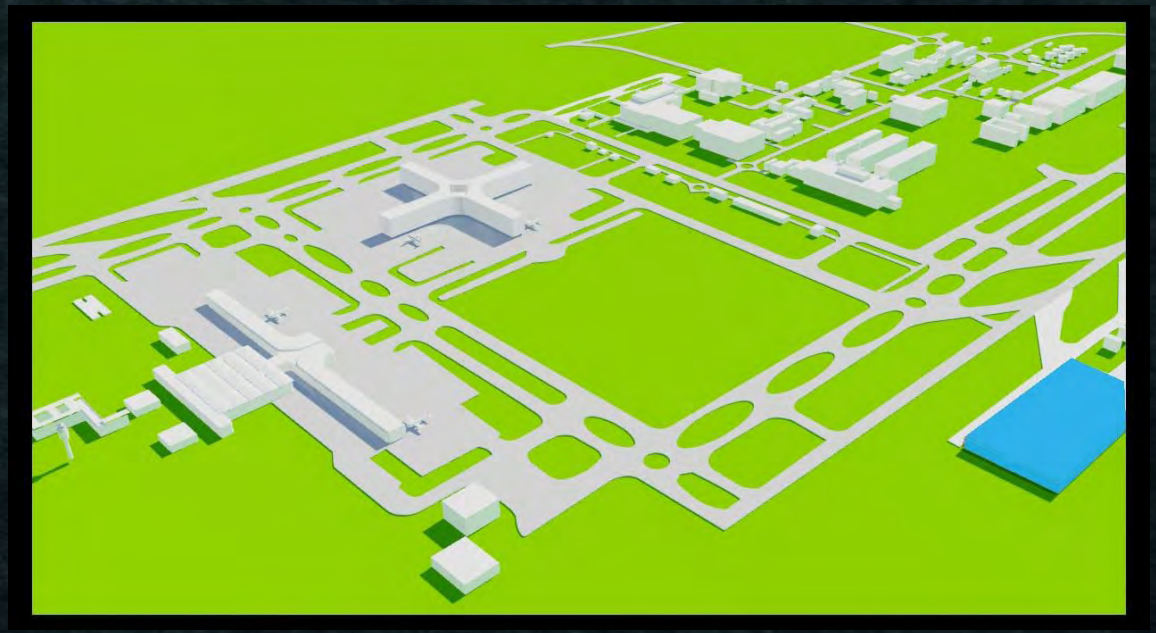


EnergyConsumption

Sewerage Treatment Plant

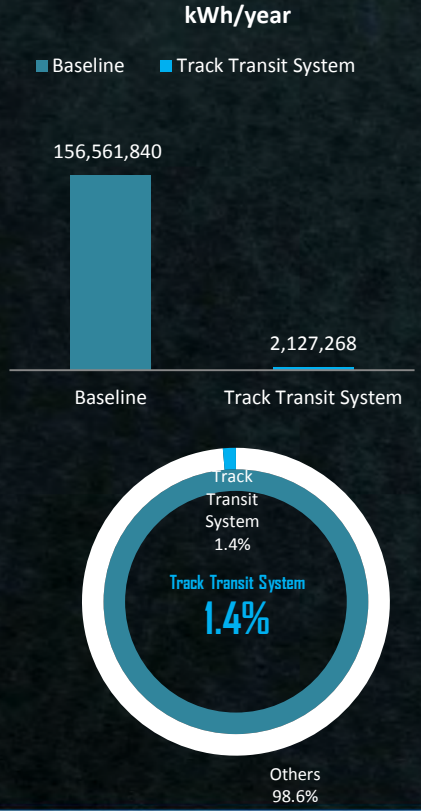


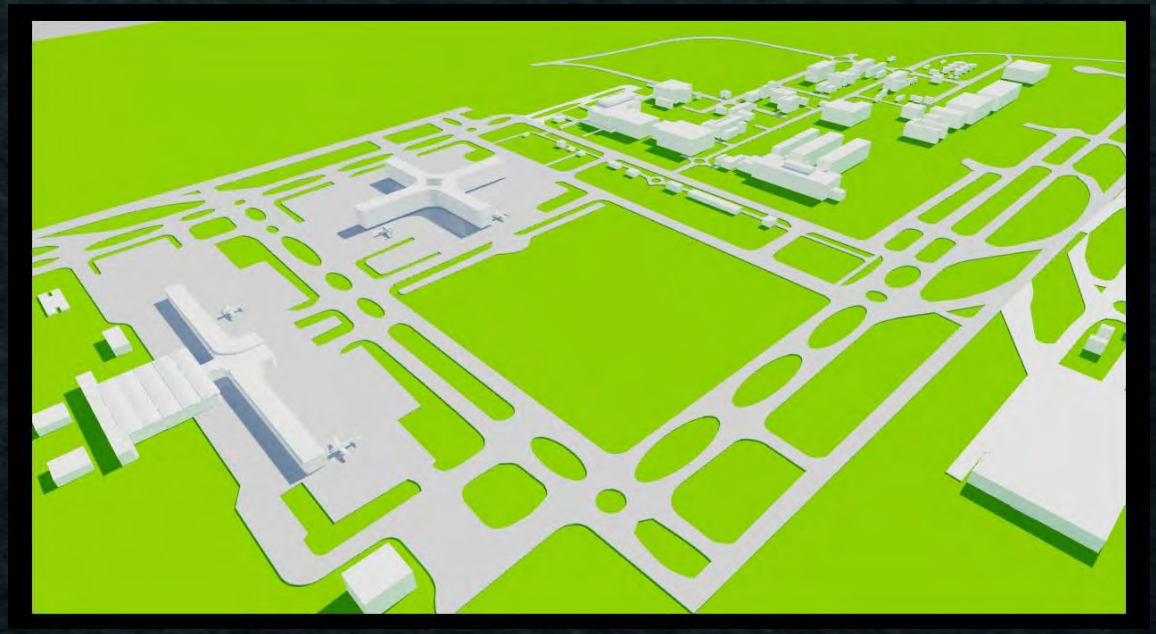




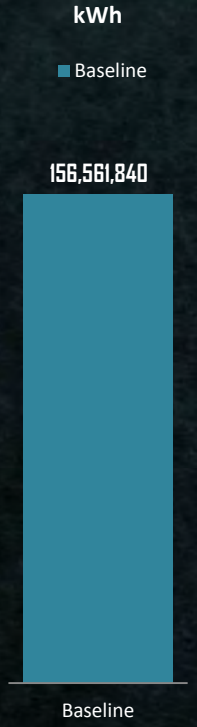
EnergyConsumption

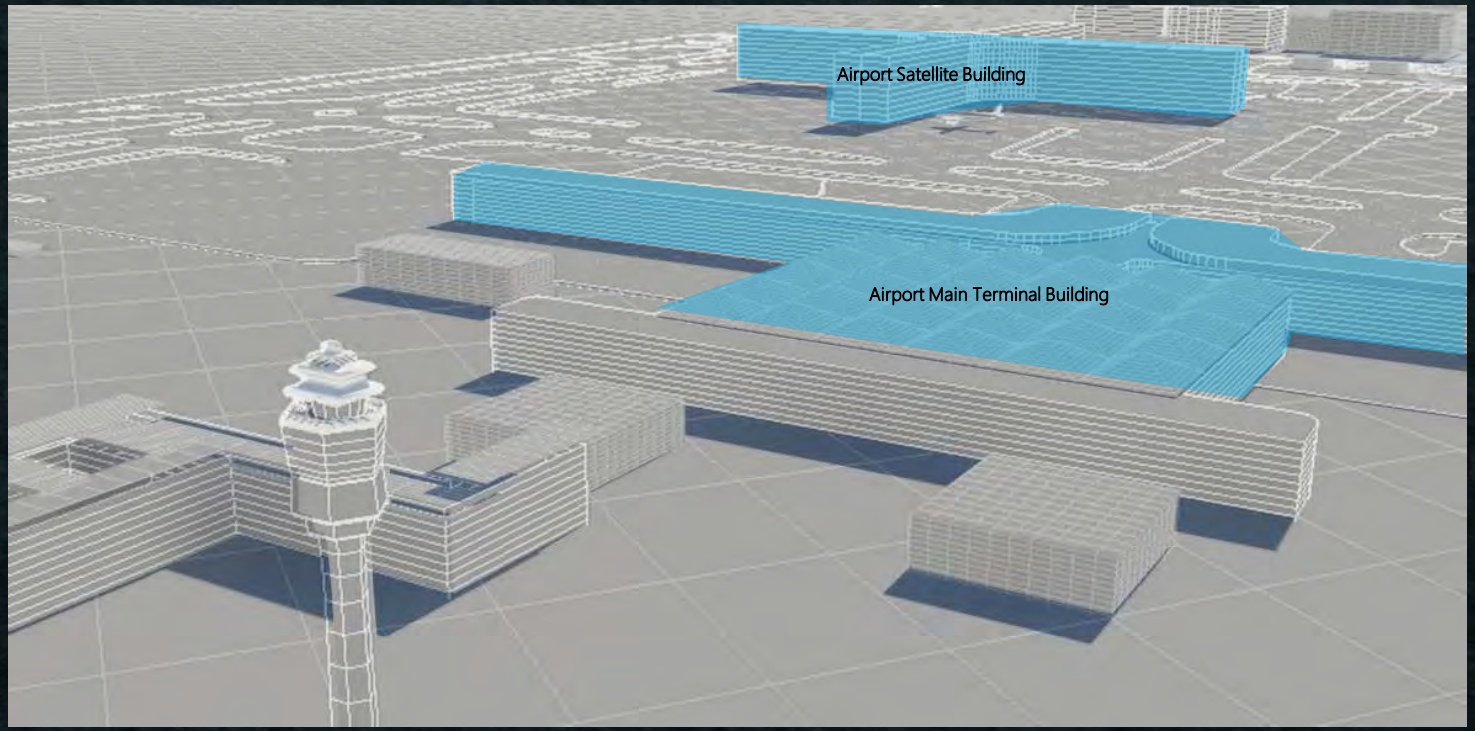
Track Transit System





EnergyConsumption



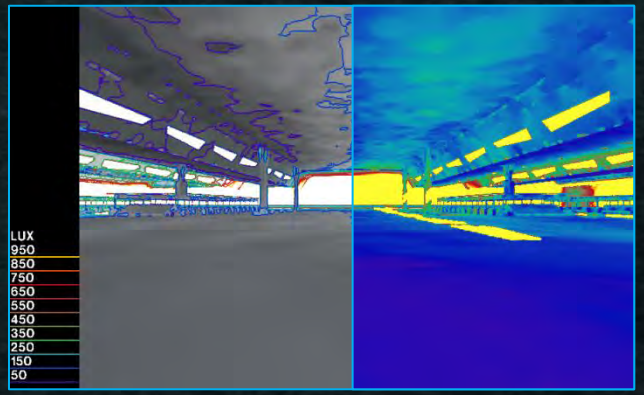


EnergySaving Strategies

Architectural Passive Elements

High performance glazing

Roof

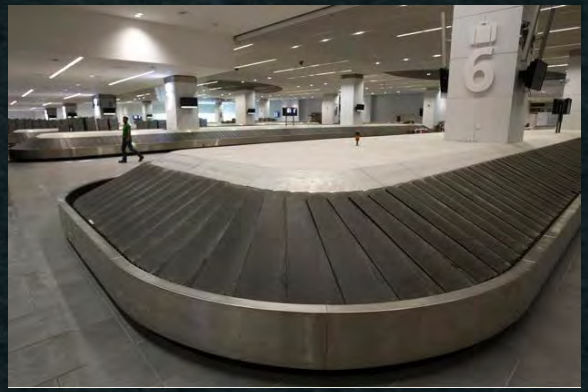


Daylight harvesting for terminal and piers

EnergySaving Strategies

Mechanical & Electrical Elements

CO_2 Sensor Ventilation Strategies



Baggage handling system

VSD Fans and VAV boxes

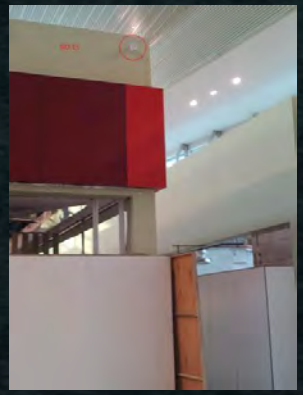
EnergySaving Strategies

Mechanical & Electrical Elements

Lighting Power Density (LPD)

High Fan Efficiency and Electrostatic Precipitation Air Filters

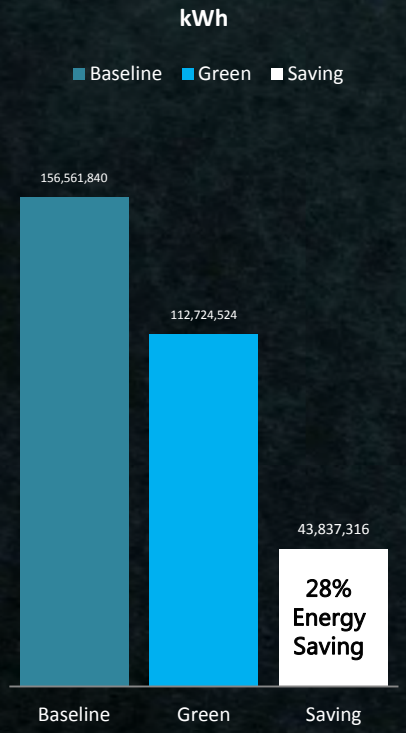
Jet Diffuser Ventilation Strategies

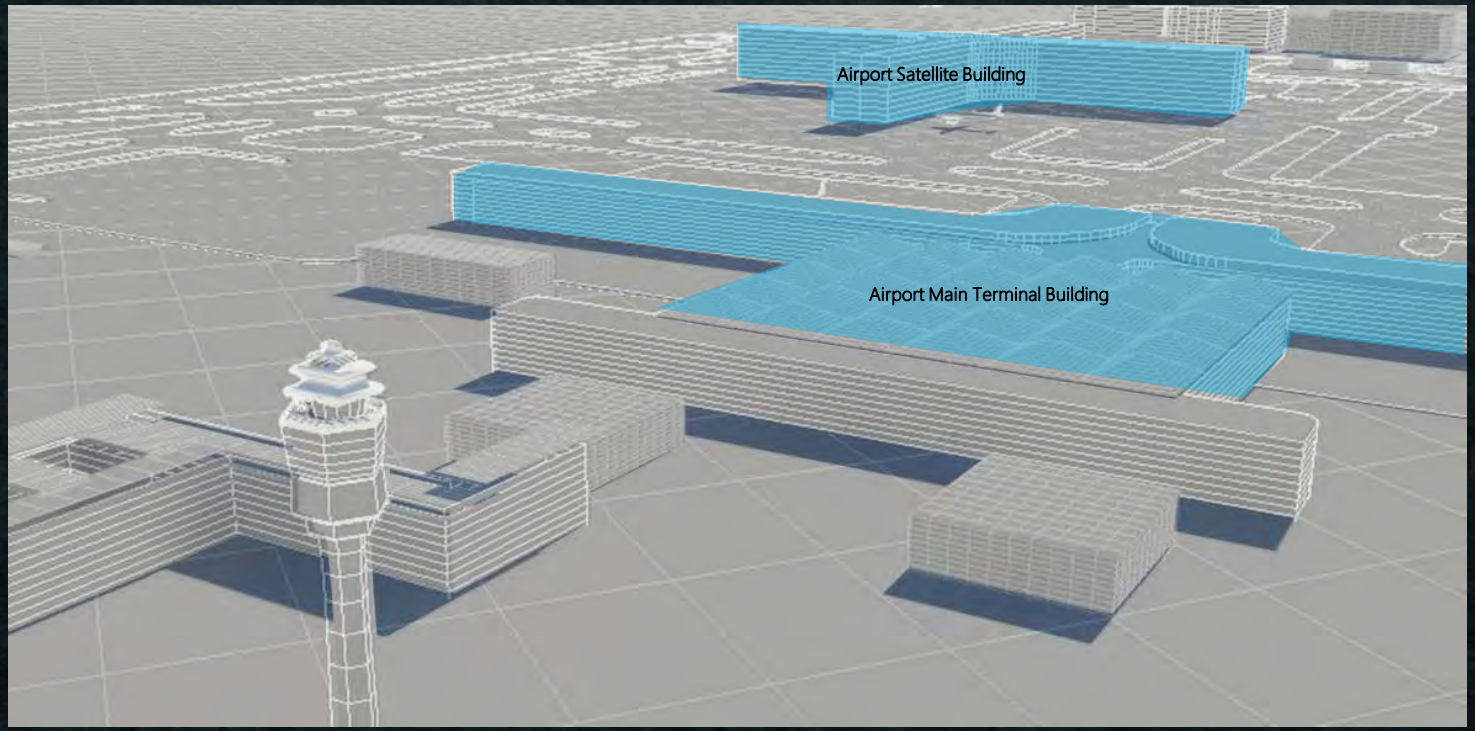


Daylight Sensors

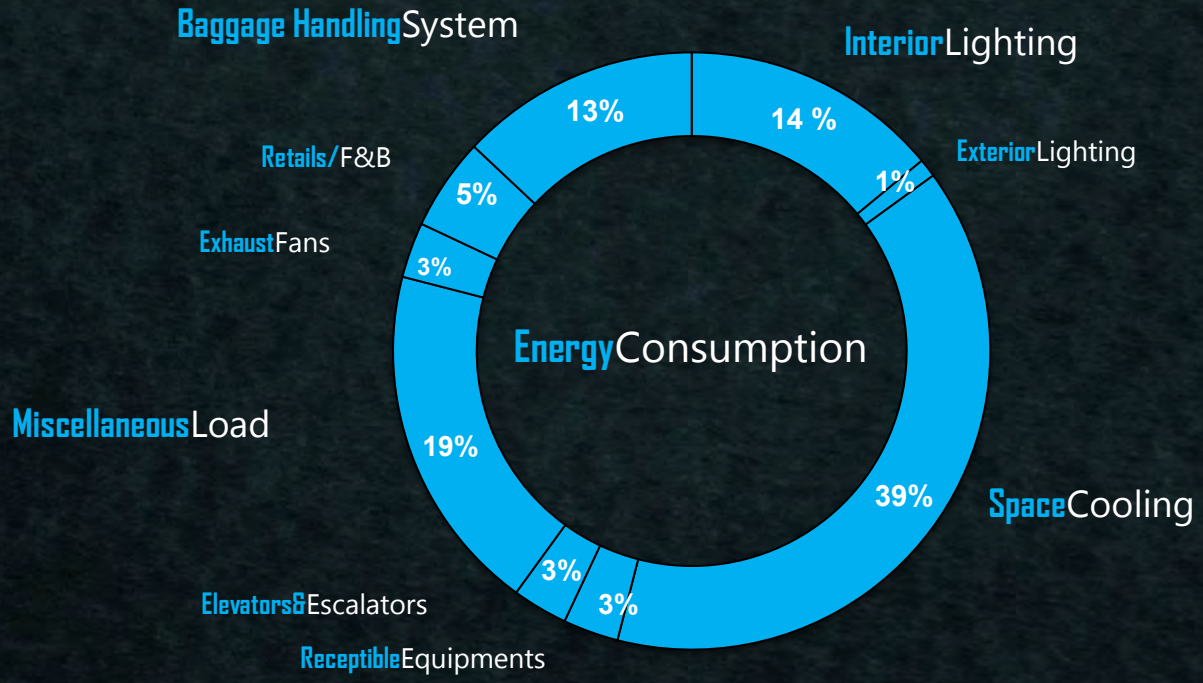
EnergyConsumption

EnergyConsumption



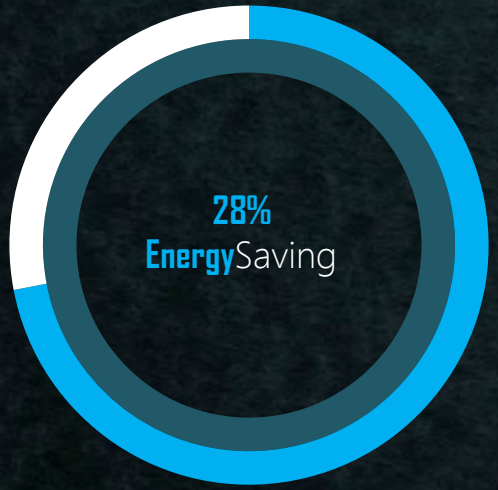


EnergyConsumption



EstimatedEnergySaving

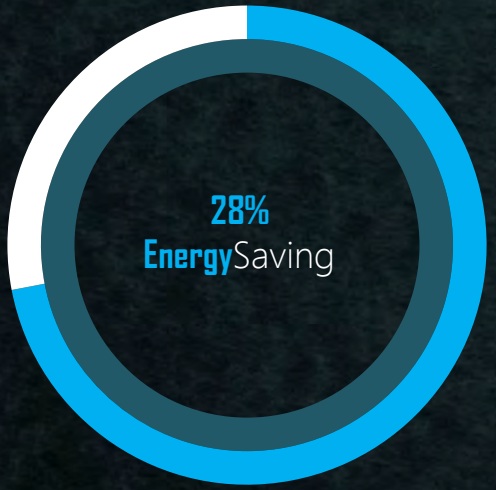
37,602,290 kWh saved



Base Case
Green Airport
Saving

Basecase: Actual data on site

EstimatedEnergySaving

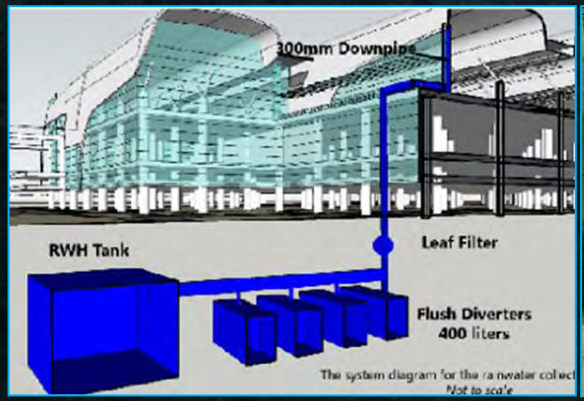


37,602,290 kWh/year x RM0.365

RM13,724,835/year

WaterConsumption

WaterSaving Strategies



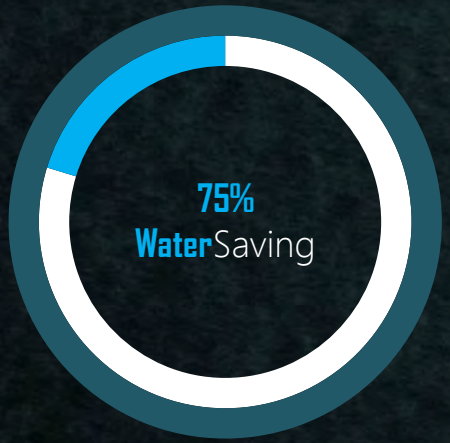
Rainwater Harvesting

Air Conditioner Condensates

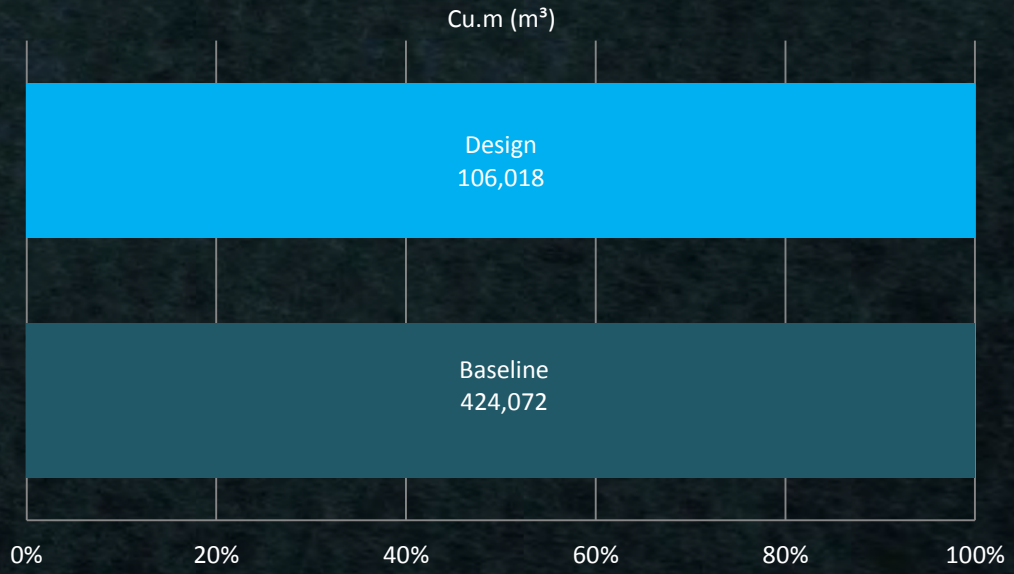
Water Efficient Fittings

EstimatedWaterSaving

318,054 m3 saved

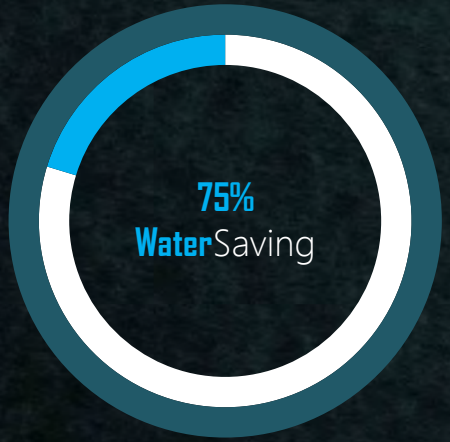


Baseline
Design
Saving



EstimatedWaterSaving

Airport Potable Water Consumption



Baseline
Design
Saving

	Baseline (m^3)	Green (m^3)
Irrigation	5,992	2,130
Flush Fixtures	195,000	98,139
Flow Fixtures	223,080	93,403
Subtotal (A)	424,072	
Less		
AHU Condensate Water		25,617
Rainwater Harvesting		62,037
Total Potable water used (B)		106,018
Total Potable Water Saving (A-B)		318,054

EstimatedWaterSaving

Airport Water Consumption

318,054m^3 potable water is saved

WaterSaving

Airport Water Consumption

Home » Consumer »

Water Tariff

WATER TARIFF

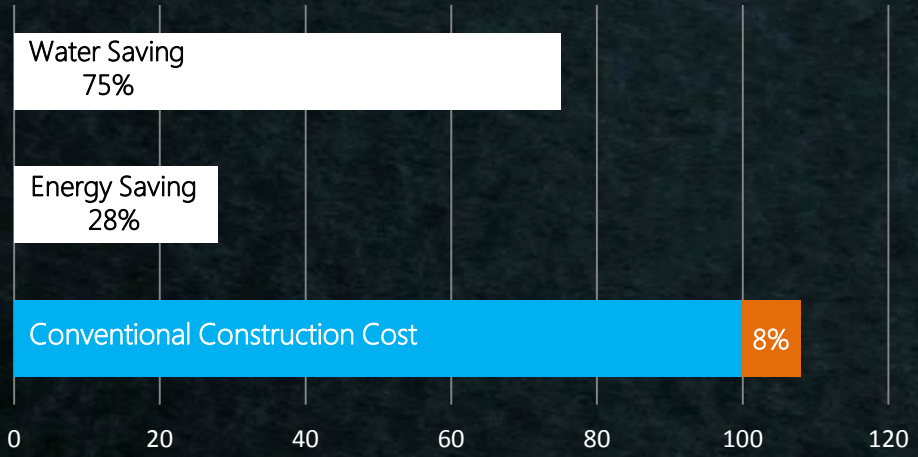
USAGE	TARIFF CODE	PRICE/CUM (RM)	MIN.PAYMENT (RM)
Domestic Usage	10		
0-20 m³		0.57	6.00
21-35 m³		1.03	
35 m³ and above		2.00	
Commercial (Inclusive of Public Swimming Pool)	11		
35 m³		2.07	36.00
35 m³ and above		2.28	
Government Department	12	1.61	17.00
Religious Places	13	0.46	6.00
Ship	14	4.23	
Charitable Organizations	15	0.58	6.00
* Condominium/Apartments	17	1.38	173.00
* Low Cost Flats/Apartments	18	0.80	35.00
* Army Camps/Estates/Govt. Quarters	21	1.00	12.00

* Applicable to bulk meter only.

318,054m³ x RM 2.28

RM725,163/year

ReturnOn Investments



Water Saving + Energy Saving

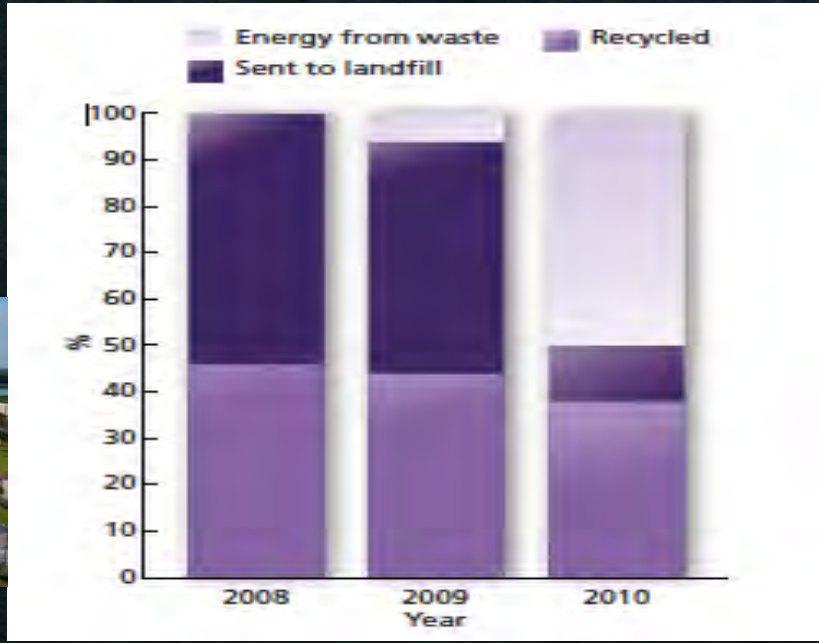
RM725,163 + RM13,724,835

RM14,449,998

ROI=GreenPremiumCost/Saving

5.52 years

Green targets – example airports



Source: Heathrow Airport Data

Waste generated through infrastructure projects involving demolishing, constructing and refurbishing old buildings, aircraft stands, taxiways, roads and tunnels.

Source: Heathrow Airport Data

rall Strategies – lowering Carbon Emission

Levels of ‘green’ action – Airports

“Influence”

- They need to influence industry partners to reduce emissions from aircraft during take-off and landing and support Government policy.

“Guide”

They need to guide emissions resulting from aircraft moving on the ground and from the activities of companies and staff based at the airport:

- -managing ground aircraft movement
- -staff travel
- -operational vehicles
- -water and waste

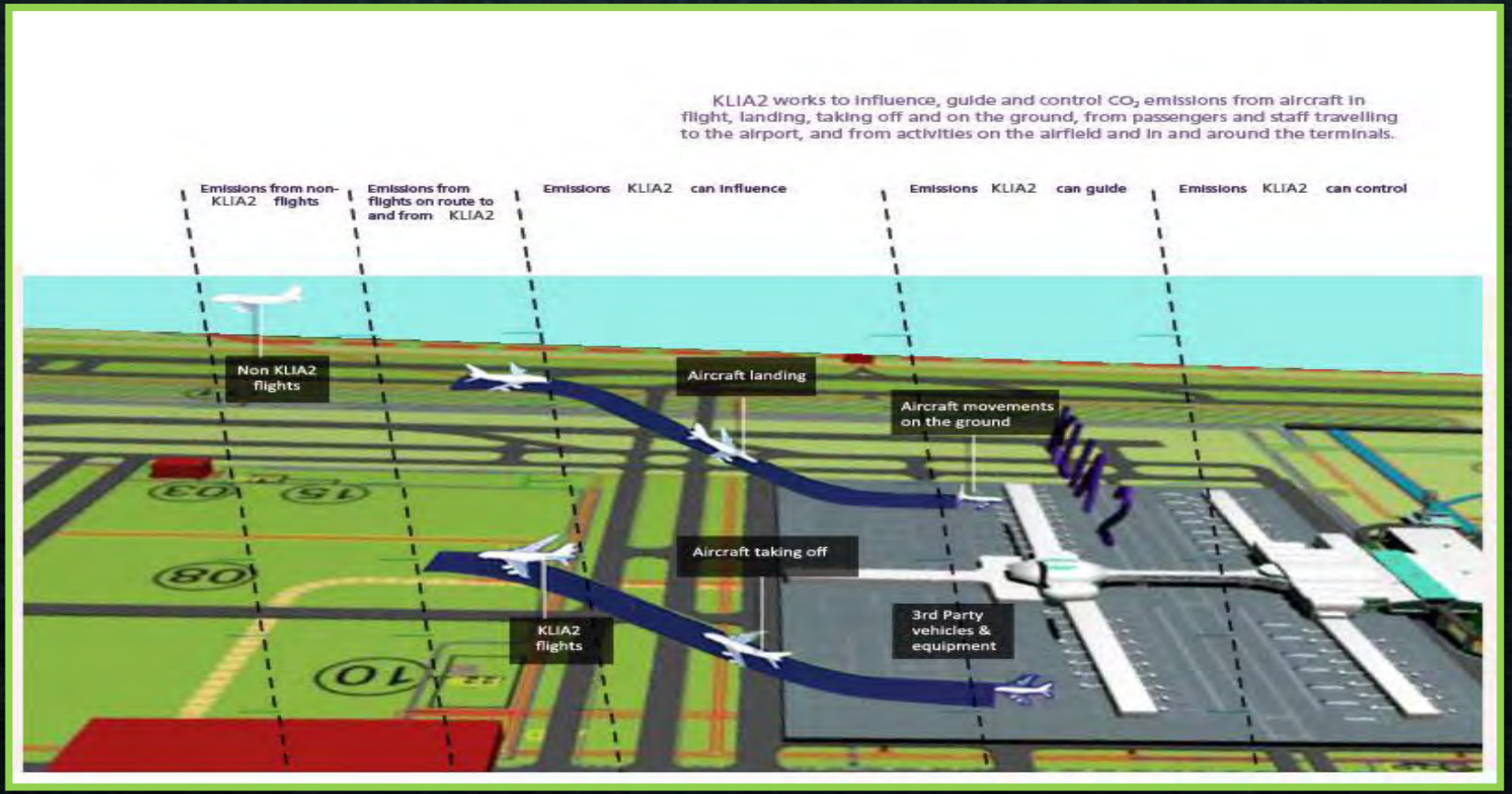
“Control”

They need to control emissions through a combination of energy efficiency initiatives and investment in less carbon intensive energy sources and buildings

The green 'big' picture - Carbon Emission According to Scope

Scope	Category	Annual Carbon Emission (MT CO_2-eq)	
		Baseline (m^3)	Green (m^3)
Scope 1	Company Owned Vehicles	985	825
	Direct Combustion	129	129
Scope 2	Electricity Usage	44,353	92,417
Scope 3	Electricity Consumption by Tenants	2,971	
	Business Travel	726	725
	Employee Commute to Work	11,726	6,976
	Passenger Land Transportation	27,310	28,728
	Ground Services Operations	5,189	4,539
	Aircraft Movement	688,531	626,845
	TOTAL ANNUAL CO_2 EMISSION (MT CO_2-eq)	832,889	761,186
	Percentage of Reduction	9 %	

Steps For Reduce Of Carbon Emissions



Thanks to...The

Malaysia Airports Berhad

MASepang
Tenaga Nasional Berhad

Air Asia Bhd

WCT Construction Bhd
LKMD Architects Sdn Bhd
KTA Tenaga Sdn Bhd

UEM – Binapuri JV
Gadang Engineering Sdn Bhd

EEC Sdn Bhd
IEN Consultants Sdn Bhd
Skala Sdn Bhd
Pureaire Sdn Bhd
Cofreth Sdn Bhd
Enmac Sdn Bhd
Skala Design Sdn Bhd
HLA Architects Sdn Bhd
RPM Engineers Sdn Bhd
Scott Wilson Sdn Bhd
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Prolight Sdn Bhd

Hi Tech Waste Sdn Bhd

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Thank You