TERASPIN

A.T.E. Ahmedabad

CONTENTS

01 **INTRODUCTION**

A.T.E. is an engineering group that creates products and technologies, living by the values of sustainability, care, commitment, openness and innovation. The operations of the group require us to have our own laboratories, assembly and manufacturing spaces, and collaborative offices.

Thus, while planning our workspaces in Ahmedabad, our aspiration is to create an environment that echoes our values and enhances our effectiveness at work. We want our offices to be functional - comfortable, user-friendly, supporting our 'do-it-yourself' style, allowing people to walk around, and talk and work together, thereby negating any sense of hierarchy. The aesthetic should be 'unfussy' - clean lines and durable finishes; to borrow a quote from Einstein, "everything should be as simple as possible, but no simpler."

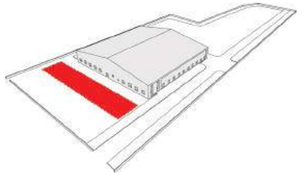
As a firm designing thoughtful and high-tech products, we need workspaces that are open, foster collaboration, enable prototyping and testing, and can be re-configured if needed. At the same time, we also want to be environmentally conscious and showcase our own ideas and our 'green' products for health and comfort in a Gold LEED certified facility. We are happy to have assembled a team that is diverse in skills but unified in purpose, thereby helping us get to our goals.

Social spaces such as the cafeteria and meeting rooms open out to a covered verandah and an adjacent paved courtyard. The flexibility of spaces allows different permutations of social interactions.

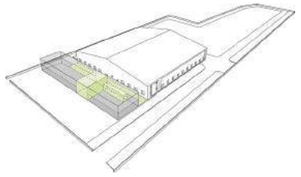
DESIGN AND TECHNOLOGY

Construction of the built environment using a combination of appropriate local technology as well as culture-specific spatial practices ensures a relevant aesthetic and efficiency of the built form. The intention in the TeraSpin | A.T.E. office building has been to create a pleasant work environment which is familiar to the users as well as one that responds to the aspirations of the company in terms of its work culture. Further, technology has been used to enhance the experience of these spaces by creating comfortable environmental conditions. This was achieved by countering the existing local conditions of extreme heat, dryness, and variations in temperature through the day and year. Furthermore, the challenge lay in achieving this while also encouraging or experimenting with sustainable practices. One way of dealing with this issue was the use of renewable sources of energy, thereby reducing one's carbon footprint. The other was to reduce the emission of harmful waste into the atmosphere.

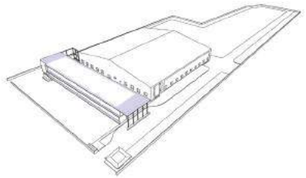
The design of the TeraSpin | A.T.E. office building integrates local conditions such as climate, orientation, and a high water table, and responds to the existing factory on the site in terms of its access, connectivity and scale. These factors enable the building to function more efficiently, not only in terms of comfort but also through design, to create an environment that facilitates interaction.



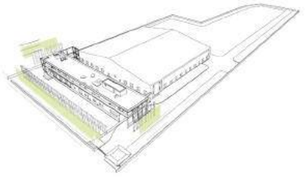
EXISTING CONDITIONS



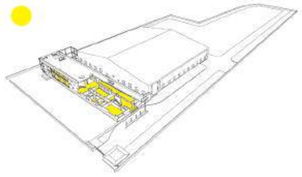
MASSING AND ZONING



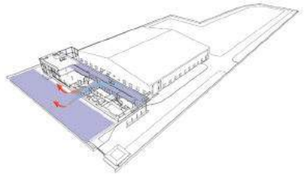
SUNSHADING



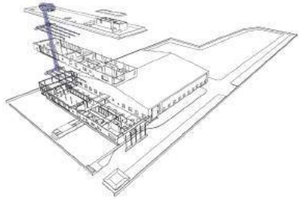
GREEN WALL AND MISTING SYSTEM



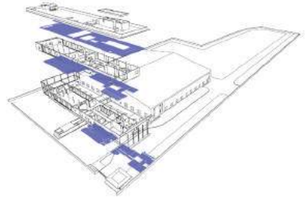
NATURAL DAYLIGHT



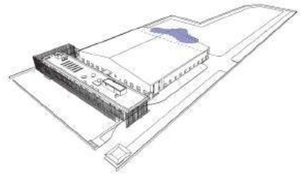
PASSIVE VENTILATION



AMBIATOR



STRUCTURAL COOLING



RAINWATER HARVESTING

LANDSCAPING

DESIGN FEATURES

The TeraSpin facility of A.T.E. is used for the manufacturing of critical components of textile machinery required for yarn spinning machines. The facility houses a factory and has an office block in the front. The complex was conceived, designed and built as an energy-efficient and environment-friendly facility which would naturally meet LEED and other certification requirements.

The programme brief for the office building includes spaces for housing the IT facility, the office of the Resident Director, the Operation Head's room, a library space, store rooms, conference and meeting rooms along with the reception and waiting areas, in addition to open office spaces. The brief required the building to be air-conditioned only where this was critical, leaving other spaces to be cooled through passive methods and by fresh air cooling systems. Moreover, the brief required that the relationship between the different spaces be organised in a way so as to break away from typical office spaces that imply very strict hierarchies.

The final design thus broke away from the conventional office building typology of an air-conditioned glass box so that the structure does not completely rely on external sources of energy. The building includes naturally ventilated outdoor spaces that maintain temperatures, thereby making them suitable for use even during the summer months. The indoor and outdoor spaces flow into each other as one traverses through the building. Some of these spaces can in fact be used as informal extensions of the office and meeting spaces.

Image of the model

03 SITE DESCRIPTION

LOCATION

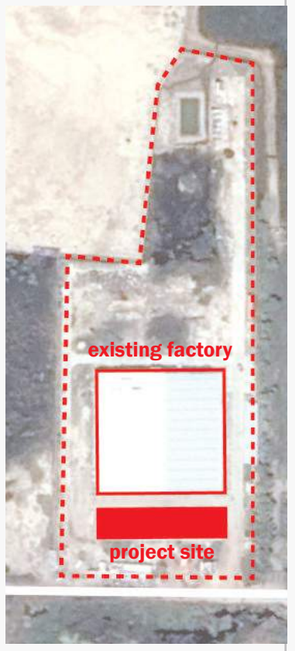
The city of Ahmedabad is connected to other cities like Rajkot, Gandhinagar and Vadodara via highways which serve as industrial corridors for different sectors. The TeraSpin | A.T.E. factory is about 200 metres off the NH 8A connecting Ahmedabad and Rajkot near a small settlement called Sari in the Changodar area. The size of the plot of the office and the factory site is about 21,000 sq. m., and the plot boundary is shared with another industrial unit. The factory and the office building are part of the Changodar Special Investment Region (SIR), located near Ahmedabad and on the Delhi- Kandla Highway. The industrial stretch starts about 10 km. away at Sarkhej and extends up to GIDC, Kerala (beyond Bavlat). The total industrial agglomeration spreads up to nearly 20 km. with 400 industrial units located in the SIR. The area of the SIR is 319 sq. km. (31,900 hectares). The existing industrial development is in the form of a ribbon development along the NH 8A.

The factory is located somewhat in the centre of the plot. Thus, the first challenge was to find the ideal site for the office building within the plot itself and define the footprint of the building. After several studies it was decided that the ideal location would be in front of the factory - in a sense to create a façade for the company - which the softer programme of the office building allowed for easily.

The office was notionally perceived as an extension to the existing factory building, though functionally and architecturally, the two are extremely different typologies within the category of 'workspaces'. Therefore, establishing an architectural relation that was functional between the two buildings standing right next to each other was important.

Location of the site:
25 km. from the centre
of Ahmedabad city

Proximity: 250 m
from the highway



Project site in relation to
the existing factory

LOCAL CONDITIONS

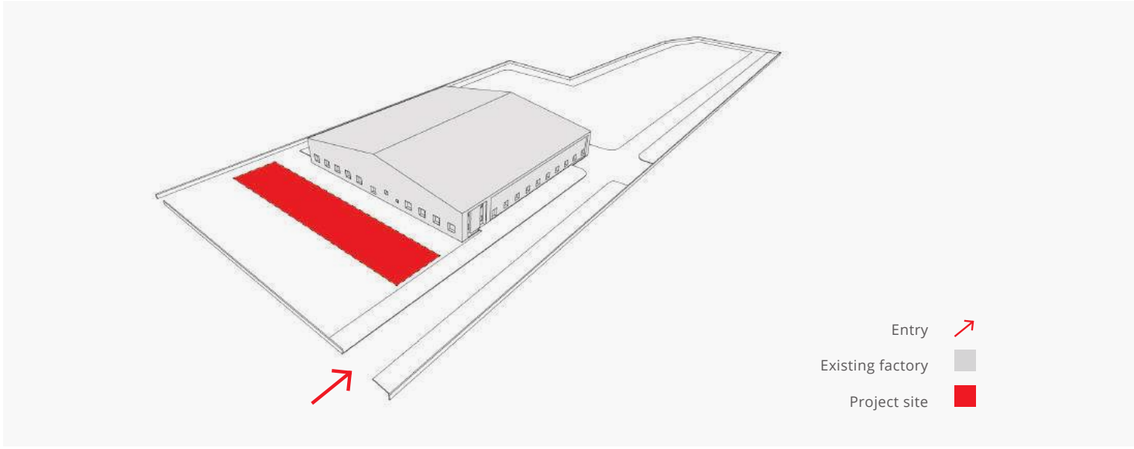
Latitude: 23.1°N
Longitude: 72.6°E
Climate: Hot and dry

The Changodar region experiences a hot and dry climate (like that of the adjacent city of Ahmedabad) with extreme temperatures, low humidity and mild rainfall. Designing a 'green' building in these conditions is a challenge as advanced forms of 'green' building technology have to be adopted to counter the extreme climatic conditions. This involves harnessing of solar energy, integrating passive methods of cooling in the architectural design, and use of low-energy consuming systems for the building.

The level of the plot at Sari, vis-à-vis the highway, was a matter of concern. While the construction of the office was underway, the level of the highway was raised, thereby rendering the plot level lower than that of the highway. Furthermore, the ground water table in this zone is high, owing to which the plot as well as the access road often get flooded during the monsoon. Therefore, adequate filling of the plot in order to raise its level near the entry points, alongwith thorough rainwater harvesting methods have been adopted for the site.

Interior of existing factory

FACING PAGE
Project site in relation to the existing factory



Project site line out with relation to the existing factory

04 **CONCEPT DESIGN**

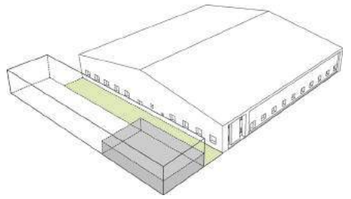
The concept of the A.T.E. office is to essentially add a bar of components as well as to create a façade for the existing factory on the site. Rectangular in form, the building is situated to create a space separating it from the existing factory. This interstitial zone is animated in ways that it can serve as an open-to-sky courtyard for social gatherings, and also as a visual green buffer between the factory and the office.

In its programmatic disposition, the office building zones in a manner to locate the social functions closer to the entrance, with the more private areas such as the open office at the other end of this rectangle. The intention is to foster employee-interaction across common areas such as the reception, the cafeteria and a large covered atrium courtyard known as the "lung."

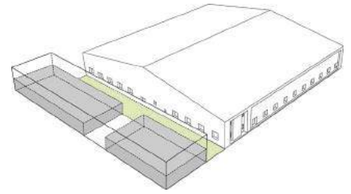
Conceptually, the building is a simple articulation of a workplace, with a variety of spaces generously washed in natural light. The façade of the building is a framework of light cast aluminium trellises upon which seasonal creepers grow.

In addition, the site is designed to drain and harvest rainwater - while the location of the building takes maximum advantage of solar exposure for photovoltaic panels on the roof. Technologically, the A.T.E. office is designed to integrate, showcase, and actively exhibit products that the company designs and fabricates.

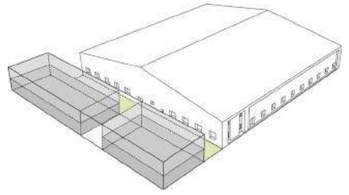
View of courtyard between office and existing factory



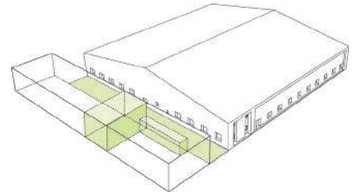
PORTAL AND RECEPTION



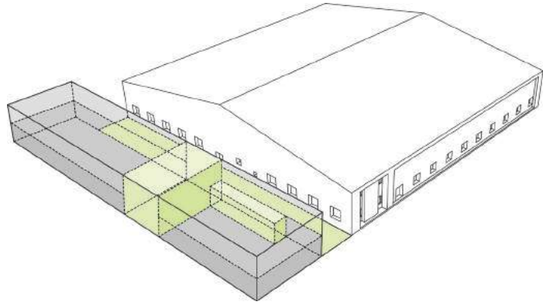
OFFICE SPACE



OFFICE SPACE FOR EXPANSION



COURTYARDS



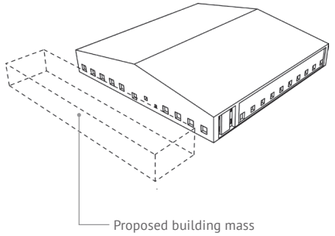
OVERALL CONCEPT

MASSING AND RELATION TO SITE

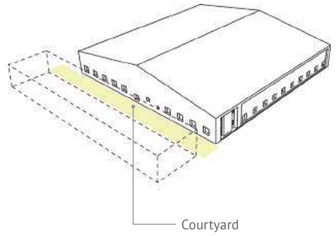
The office building for TeraSpin | A.T.E. at Sari is two storeys tall, with a ground floor, first floor and a terrace. The building massing, i.e. its height, length and orientation, are influenced by the location of the building as well as its relation to the existing factory building and the access road.

The main entry to the premises is through the north-east of the property. This gate serves as a single control point for the vehicles of the employees in the office building, workers in the factory and trucks for the loading and unloading of factory-related materials. All three entry points are located along the north face of the buildings, immediately off the main access road.

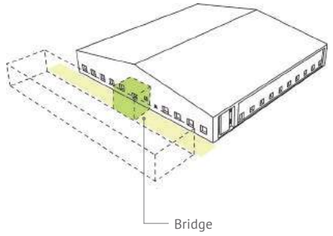
The office and factory are separated by a landscaped courtyard which maintains a social and visual connect between the two buildings. The courtyard is a multipurpose space that allows programmes from both buildings to spill over and forms a soft common area for employees working in both buildings.



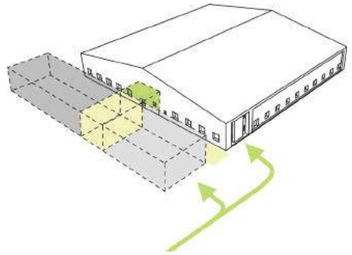
MASSING RESPONDING TO FACTORY DIMENSIONS RY DIMENSIONS



SEPARATE OFFICE FROM FACTORY WITH COURTYARD



BRIDGE TO CONNECT OFFICE AND FACTORY

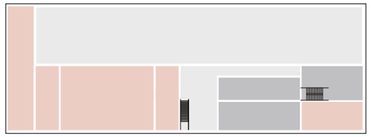


BASIC MASSING AND ZONING

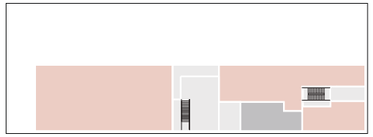
ZONING

The ground floor of the building is divided into two distinct zones with a double-height “lung” in the middle connecting the two. The public spaces of the building, such as the reception, service zones, meeting room and cafeteria, are located in the front block. Private cabins and open office spaces are away from the entry, at the south of the building.

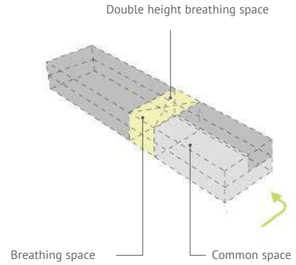
Common facilities such as the cafeteria and an internal staircase to the first floor are located centrally, adjacent to the “lung.” The first floor of the building is designed to accommodate open offices for future expansion and supporting functions such as toilets, an additional conference room, and storage spaces. The terrace is occupied by advanced 'green' building equipment such as hybrid Ambiators, photovoltaic panels, a balancing tank and radiators.



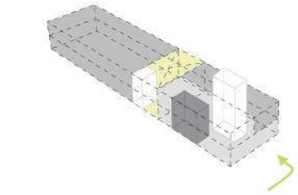
GROUND FLOOR ZONING DIAGRAM



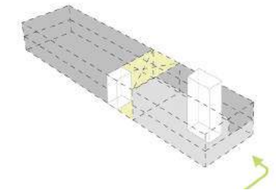
FIRST FLOOR ZONING DIAGRAM



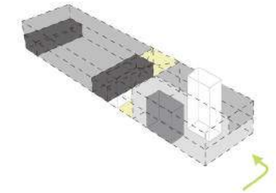
BASIC MASSING AND ZONING
2-STOREY STRUCTURE



SERVICE CORE



VERTICAL CIRCULATION



CABINS ALIGNING TO WORK SPACE
EDGES ON GROUND FLOOR

Public

Private

Circulation / Courtyard

05 SUSTAINABLE DESIGN

OPTIMISING DAYLIGHT AND MINIMISING HEAT GAIN

According to the glass specification report of Saint-Gobain Glass, the annual solar radiation exposure to the façades of the 4 cardinal directions are:

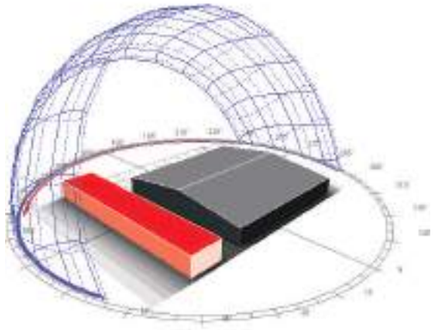
North: 2,50,400 Wh/m^2 (Low: Less direct exposure)

East: 5,00,000 Wh/m^2 (Medium: Optimum ingress of radiation)

South: 9,925,000 Wh/m^2 (High: Peak exposure)

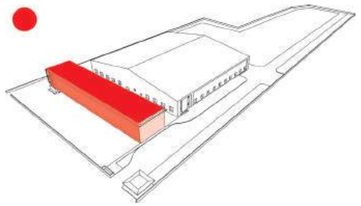
West: 7,00,000 Wh/m^2 (High: High radiation during working hours)

With the objective of minimising the overall carbon footprint, several strategies have been incorporated to optimise daylight and reduce heat gain along the façades. To reduce heat load, a green wall was introduced on the exterior of the north, east and south façades. The west façade is efficiently shaded by external blinds, as well as the adjacent factory building and courtyard landscaping. Glazed components of the façade consist of 21.5 mm-thick laminated glass panels. Laminated glass blocks 90% of the UV radiation, thereby saving energy.



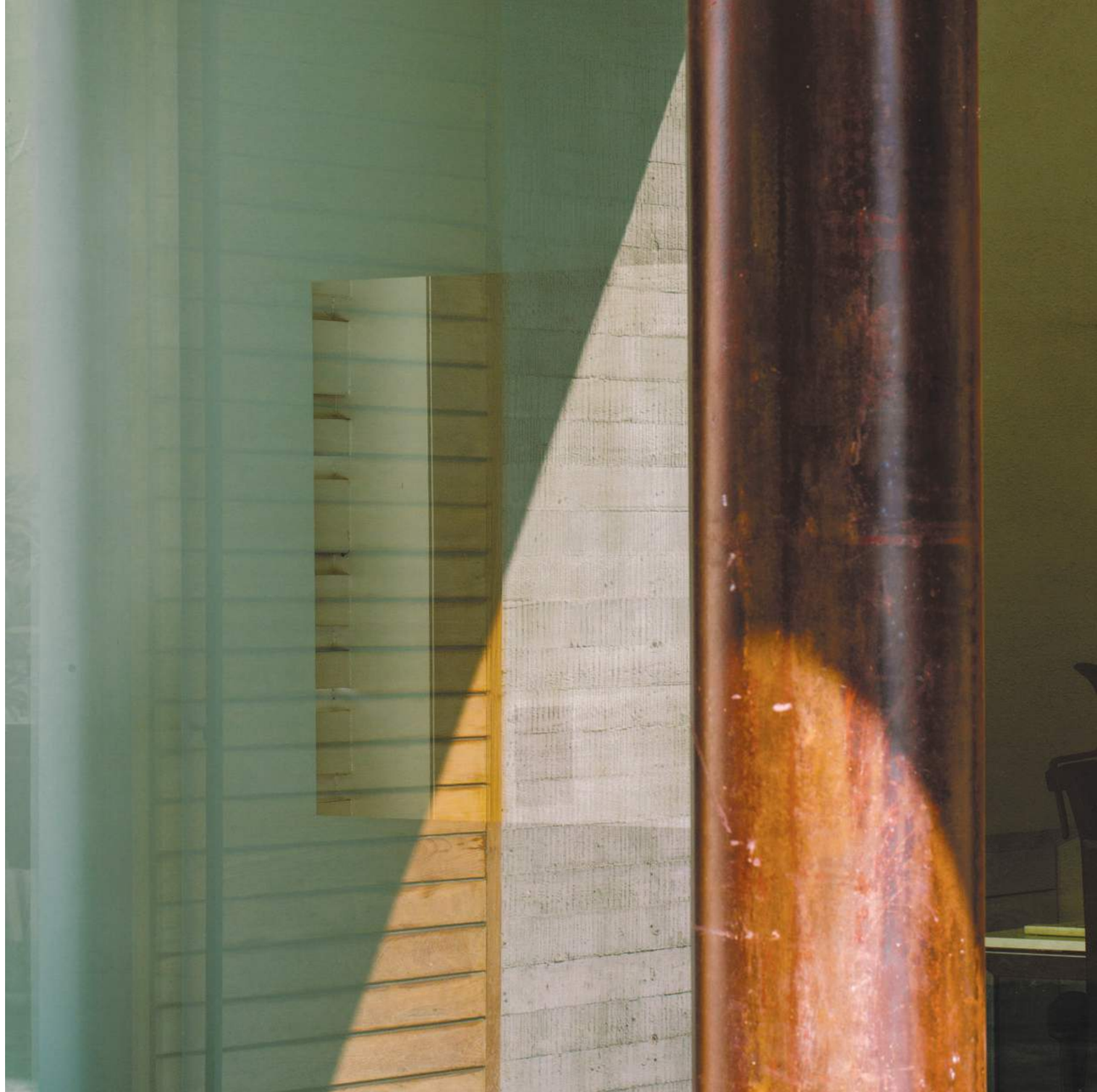
SUN PATH SIMULATION

Intense Solar Radiation
Solar Radiation Incident On The Project
Sunpath: January-June
Sunpath: July-December



Minimum Heat Gain
Medium Heat Gain
Maximum Heat Gain
North

VIEW OF GREEN WALL ON EAST FACADE



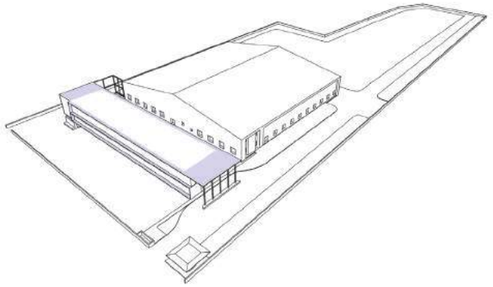
SHADING

According to the Energy Conservation Building Code of India, a west-facing overhang with a 0.35 projection factor (i.e. the ratio of a 3.5 metre internal clear height to a 1 metre overhang), provides a 20% reduction in solar heat gain, as compared to an uncovered window. A 1 metre overhang is incorporated on both the eastern and western façades, while the northern façade is well protected with a covered drop-off porch.

The office and factory building share an internal courtyard which is a combination of soft landscaping and paved areas, interspersed with trees that provide plenty of shade. Ensuring that this open-to-sky area remains shaded for a large part of the day is critical to the usage of this space. In the morning and evening, the office building to the east and the factory building to the west effectively impart shade to the courtyard. At around noon, when the sun is overhead, overhangs of the office building and trees planted in the courtyard shade approximately 75% of the paved area.

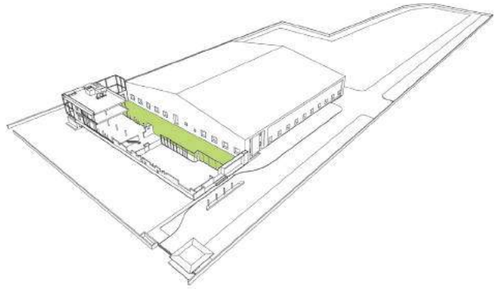
According to the glass specification report of Saint-Gobain Glass, the shading effect of the factory building to the west was considered to effectively reduce 10% of solar heat gain to the west side façade of the office building.

View of bridge from office to factory



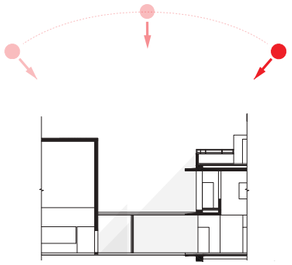
Overhangs for Shading

SHADED PORTAL

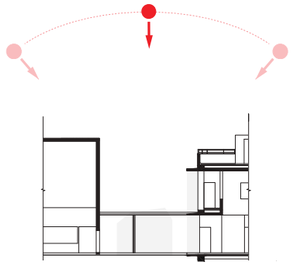


The Courtyard

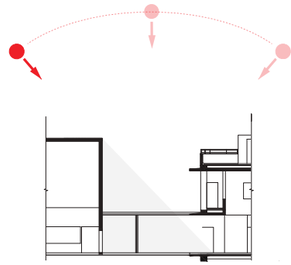
SHADED COURTYARD



Morning



Noon



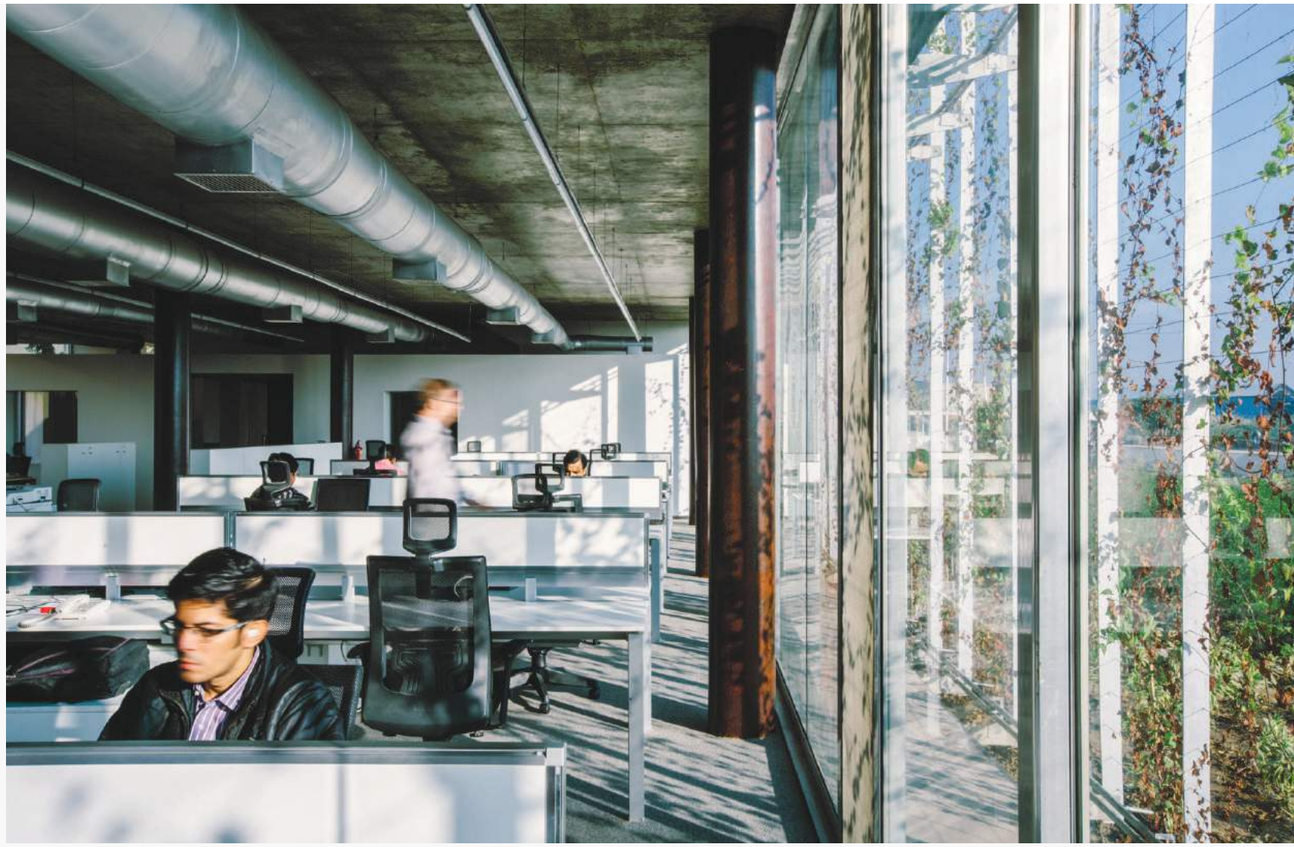
Evening

SHADES IN THE COURTYARD

NATURAL DAYLIGHT

To ensure that the interior spaces of the building are washed in natural light, the building façade is detailed with floor-to-ceiling sliding glass windows. Well-lit workspaces have proven to yield specific benefits like better health, increased productivity, financial benefits due to energy conservation, and reduced absenteeism amongst employees.

The long and narrow form of the building and minimal vertical walls facilitate the reach of natural light to all parts of the floor plate. Full-height windows abutting the open offices and the reception allow plenty of unobstructed light, making the work environment invigorating and fresh. Furthermore, the porosity of the 'lung' and puncturing of the roof with skylights allows for sunlight to enter the heart of the office building, thereby eliminating the need for artificial lighting during the day and facilitating the growth of plants in the 'lung'.



View of open office space. Morning light creates a rich interplay of light and shadow behind the green wall. During the hottest hour of the day, cooling of the space is achieved by A.T.E. | HMX Ambiator natural cooling system. This system was integrated and exposed in the architectural design as seen in the ceiling mounted ducts.

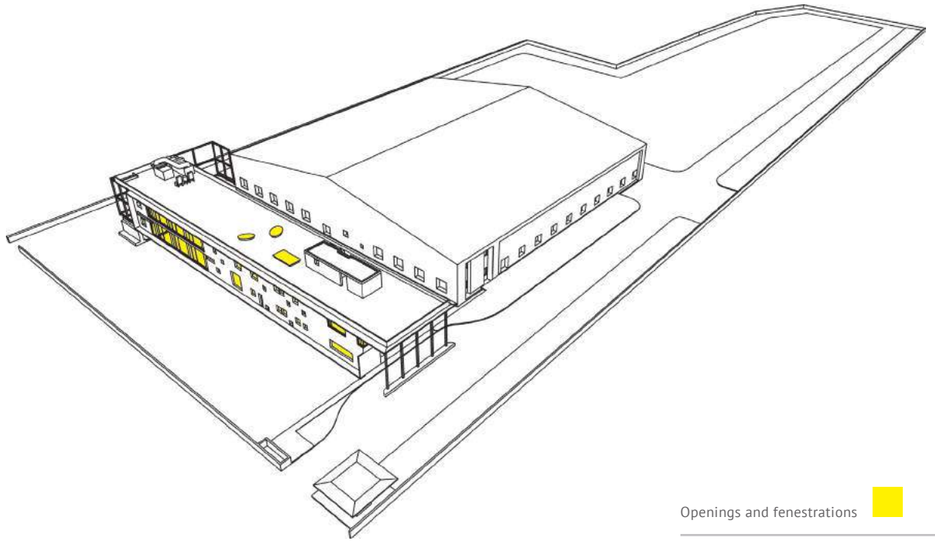
OPENINGS AND FENESTRATIONS

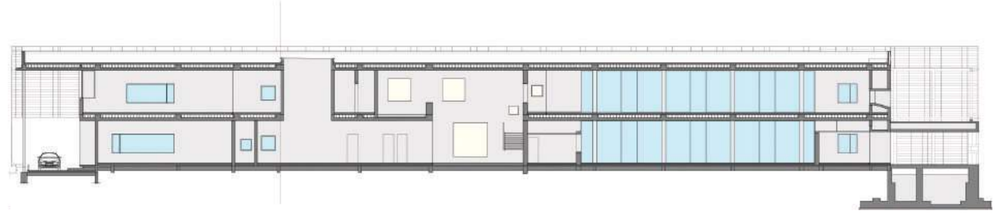
The office façade is a combination of solid surfaces, windows and openings. Fenestrations are arranged along the façade in direct response to adjacent interior programmes. For example, windows along the reception and open office spaces are large, full-height structures which run through the length of the office spaces, allowing maximum light to filter into the workspaces.

Windows abutting the conference rooms on both floors are medium-sized, which provide controllable natural light into the space. Depending on the type of meeting, the space may be used as a formal audio-visual room or alternatively, for informal discussions. Windows along the toilets are smaller, top-hung operable ones which allow for ventilation of the toilets while protecting the openings from the rain. The dimensions of the windows are restricted so as to maintain privacy.

The 'lung' is completely open to the courtyard at the ground floor on the west side, while openings run along the first floor of the west façade and the east façade-balancing performative requirements and graphic compositions.

View of circulation passage with double-height skylight





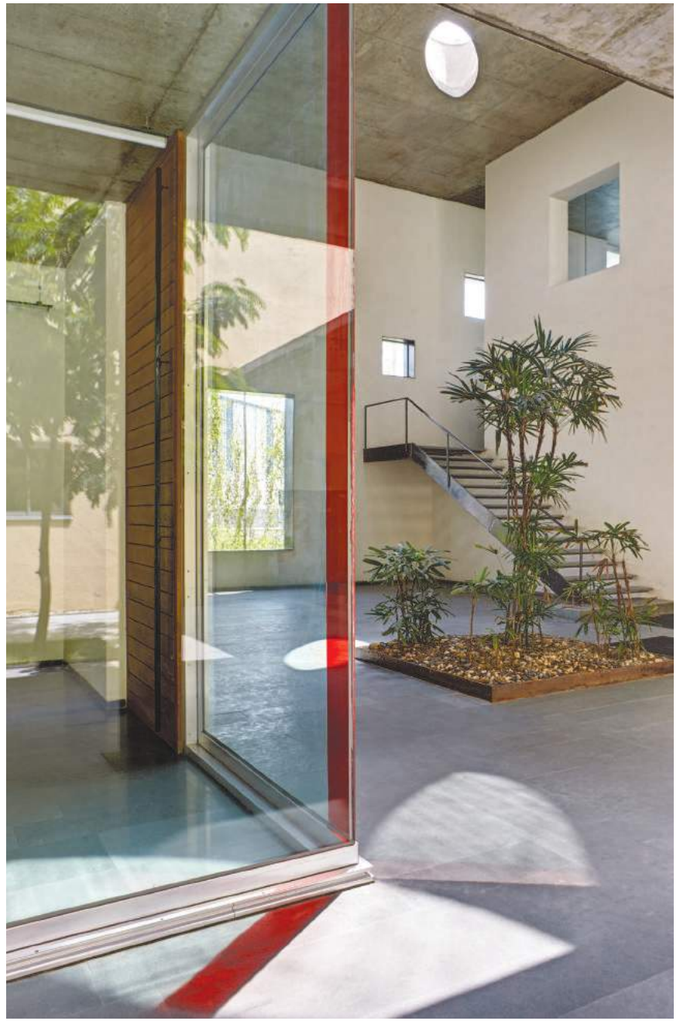
Opening

Window

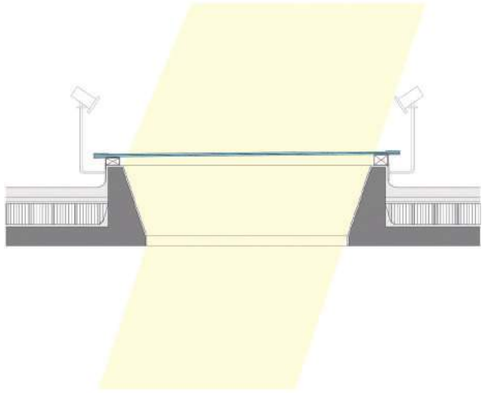
SKYLIGHT

At the TeraSpin | A.T.E. office in Sari, skylights are introduced in specific locations based on light simulation studies. A large, rectangular skylight accentuates and illuminates a passage along the service area, thereby eliminating the need for artificial lighting in this common space during the day. Similarly, the 'lung' area is naturally lit by a combination of two elliptical skylights, whose transition through the 'lung' illustrates the passage of time through the day. The skylights are technically designed taking into account the rain, light, ventilation and scale.

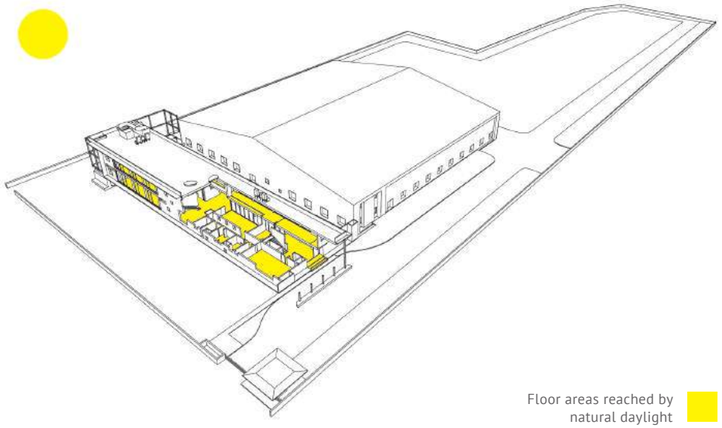
The roof slab turns into an upturned beam, thus preventing the seepage of rainwater from the terrace into the building. The glass cover for the elliptical skylights is a single piece of 21.5 mm clear, toughened glass, laid at a 1:10 slope. A gap of 75 mm between the glass and the top of the structure allows for hot air from the 'lung' to ventilate through the gap, thus encouraging passive ventilation.



View of staircase in the central lung



SECTION THROUGH ELLIPTICAL SKYLIGHT



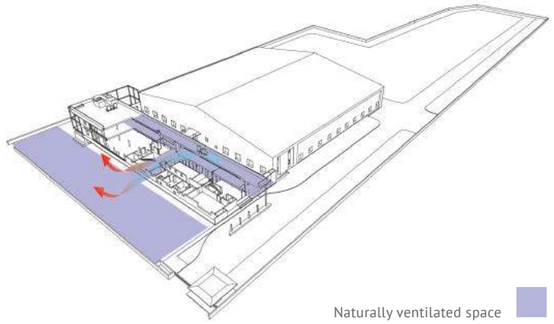
Floor areas reached by natural daylight

NATURAL DAYLIGHT PENETRATION

External view

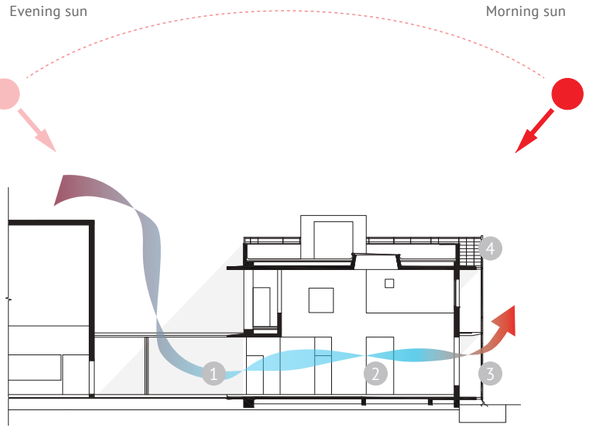
PASSIVE VENTILATION

Passive ventilation is the movement of air through a building without the use of externally supplied energy. The integration of this phenomenon into the design process of the TeraSpin | A.T.E. office has ensured that non-air conditioned spaces remain cooler, thereby saving energy and providing a comfortable working environment. Circulation passages and the 'lung' are provided with large openings along the east and west façades. Therefore, the cool air of the courtyard enters the 'lung', picks up the heat from within the building, and is pushed out from the openings along the east façade. The continuous movement of fresh air provides a healthy, comfortable atmosphere for users.



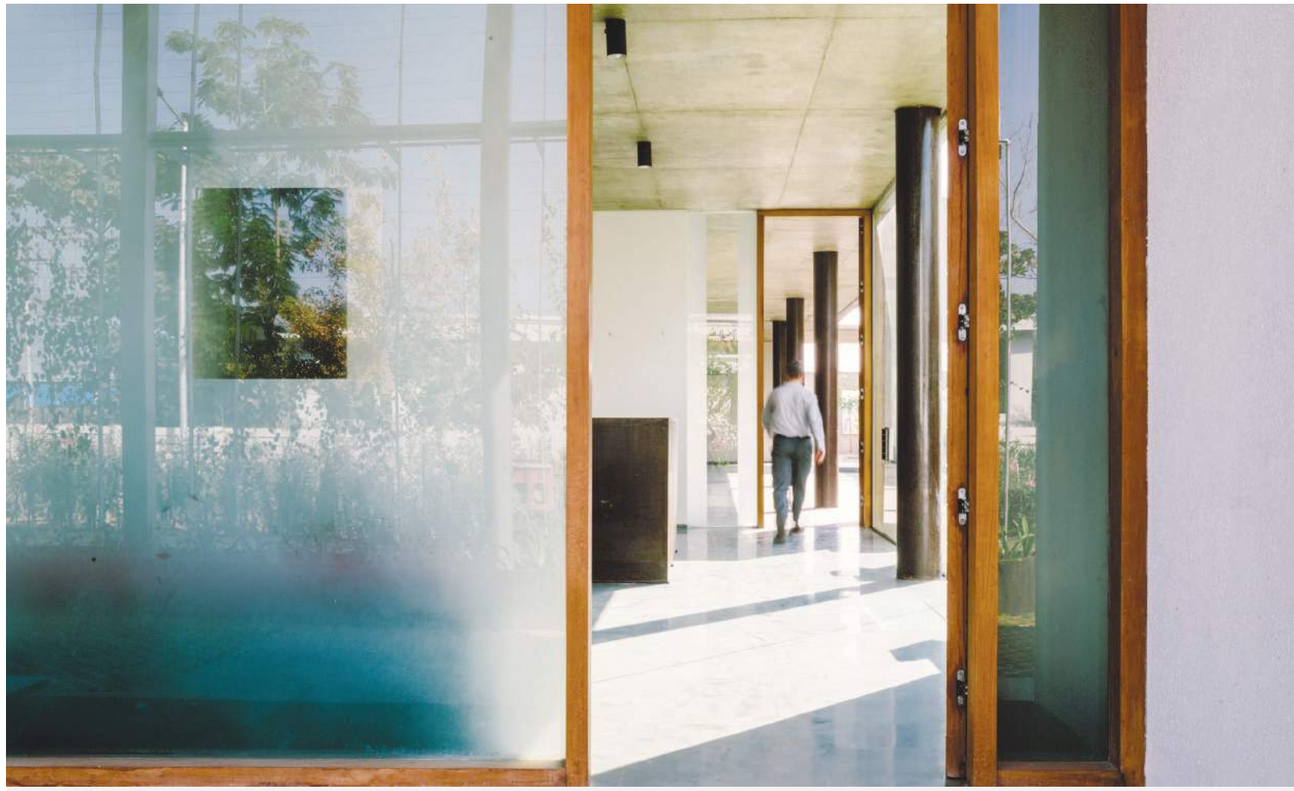
Naturally ventilated space

PASSIVE VENTILATION AND THE LUNG



MECHANISM OF PASSIVE VENTILATION

1. Courtyard vegetation creates a cooling buffer zone
2. Cross-ventilation allows for passive heat extraction
3. Green wall acts as shading screen, allowing full glazing at east elevation
4. Brise-soleil shade offices from high sun angles



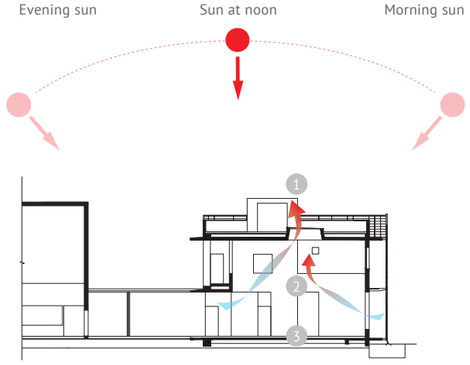
View from the main entry through the reception area towards the covered verandah

THE LUNG

The central double height space which lies between the public and private zones of the building is the “lung.” The lung is connected to the factory via a covered walkway through the internal courtyard, while a light metal staircase provides a vertical connection to the first floor.

The lung is a composed indoor-outdoor space, closed from three sides and open towards the internal courtyard. Three façades of the lung are detailed with strategically located openings, while the roof is punctured by two large elliptical skylights. Various openings on multiple surfaces encourage for cross ventilation, thus keeping the space passively cool, eliminating the need for fans or air conditioning.

A large square planter is located near the center of the lung at the ground floor, and a second larger planter is located on the first floor. The incorporation of dense landscaping within the heart of the building further cools the space, while at the same time blurring the boundary between inside and outside.



1. Sun at noon heats up the roof and air in the upper part of the building
2. Hot air rises
3. Stack effect allows for passive heat extraction

SEMI-OUTDOOR SPACE

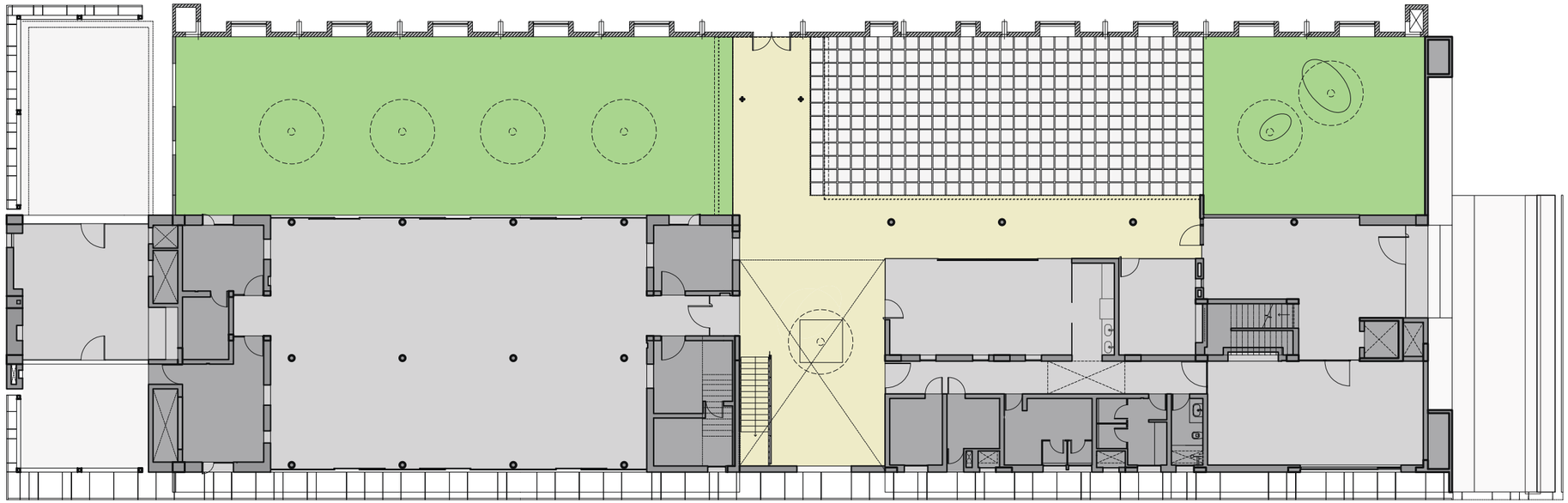
The TeraSpin | A.T.E. office hosts many spaces which are formally indoors, but are resonant with an outdoor space, or can be used in combination with one or more outdoor spaces.

The passage between the reception, the open office and the lung is a covered space dependent on natural sources of energy for lighting and cooling during the day. This verandah-like zone is also open to the internal courtyard and includes various landscaping elements. Therefore, these areas of the building have been termed as 'semi-outdoor' spaces.

The cafeteria is designed as a room which seats 24 people at a time. However, sliding glass panels forming the west façade of the cafeteria can be completely opened, allowing the space to expand into the adjacent verandah and paved courtyard. Thus the cafeteria can be used flexibly as an enclosed room or as an expanded space, depending upon the time of the year and the nature of use.

Main reception and entry lobby

Semi-outdoor space as an attractor for socialising activities- relationship between cafeteria and courtyards

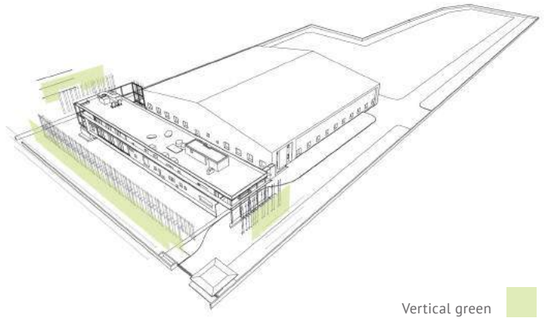


TRELLIS SYSTEM

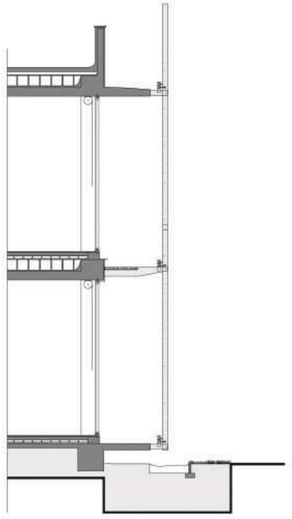
The façade of the TeraSpin | A.T.E. office is a multi-layered, dynamic living system. Its outermost layer is composed of trellis panels placed vertically along the north, west and south façades of the building. The trellis is a hand-crafted, sand-cast aluminium panel which is attached to the main façade of the building using knife brackets. Each aluminium vertical consists of two equal-sized trellis panels, which are bolted to each other at the centre and then bolted to the knife brackets at three points along the level of the floor slabs.

The trellis panels form the support system upon which creepers of the green façade grow.

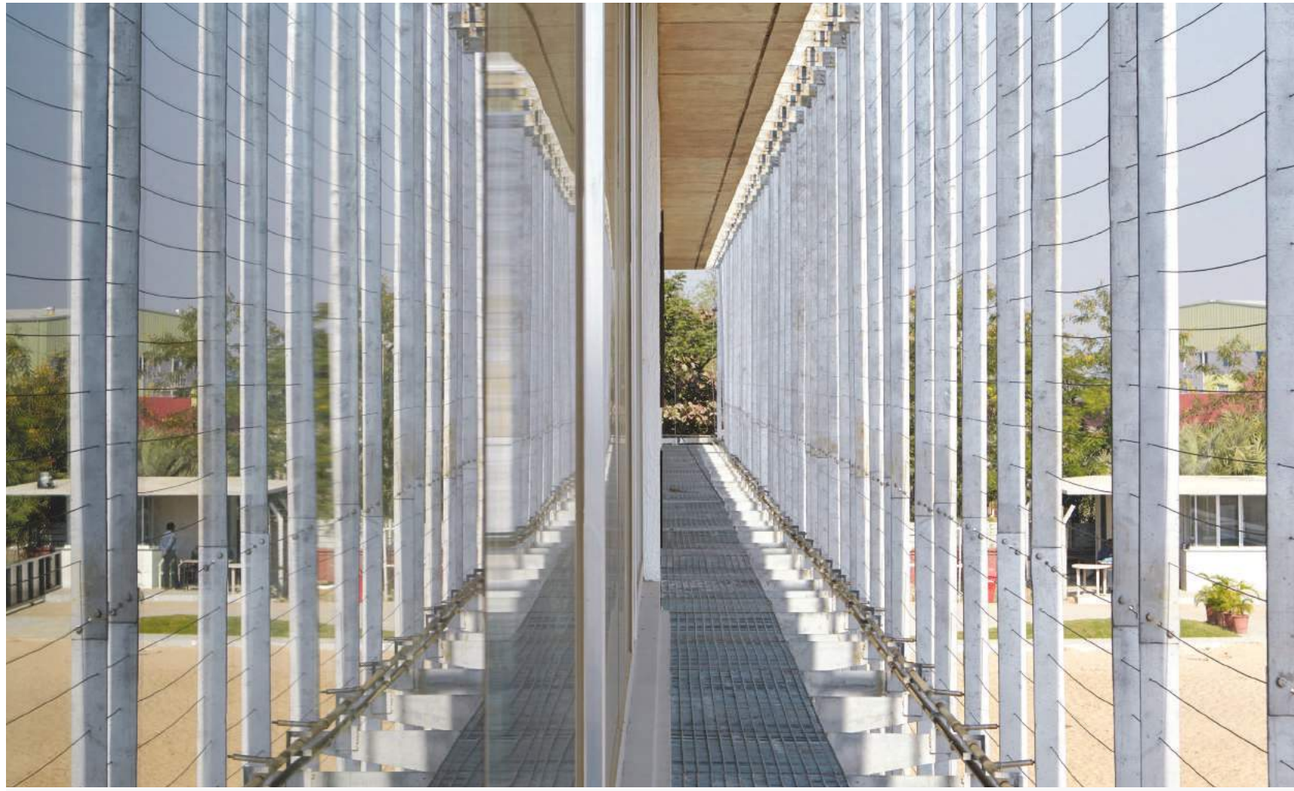
Inside of the
trellis system



GREEN WALL AND THE TRELLIS SYSTEM



Section across the
trellis system



View of the trellis system

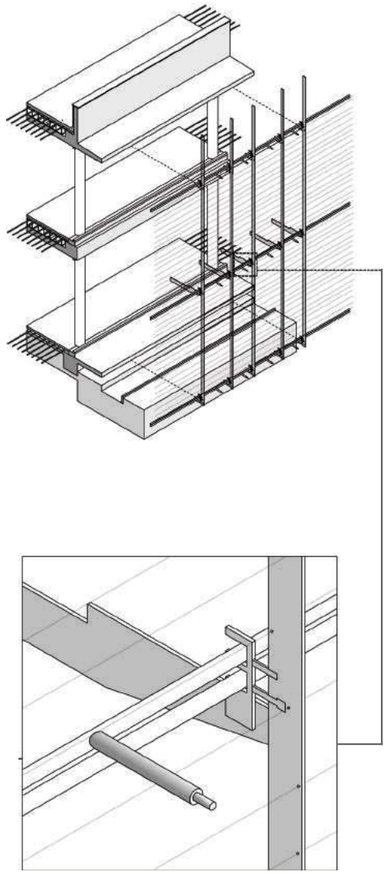
MISTING SYSTEM

The misting system consists of pumps, two lines of water supply pipes and stainless steel misting nozzles that convert water droplets into fine mist before releasing them into the atmosphere.

It is designed with two parallel water supply systems to cater to the water needs of different species in the different seasons. The façade is composed of three species of creepers, two of which have similar water requirements. Therefore the misting nozzles catering to the two species with similar water requirements lie along one supply line and the nozzles that cater to the third species lie along the second water supply line.

Stainless steel misting pipes are supported on hot dip galvanised mild steel brackets which are welded to the supporting knife brackets. The misting brackets have one pocket where a single water supply line is provided and two pockets for lengths along which both supply lines run.

Misting ensures that the green façade remains healthy and fresh. In addition, the mist removes the dust off leaves and creepers, while at the same time, creating a cool and humid micro-climate around the building.



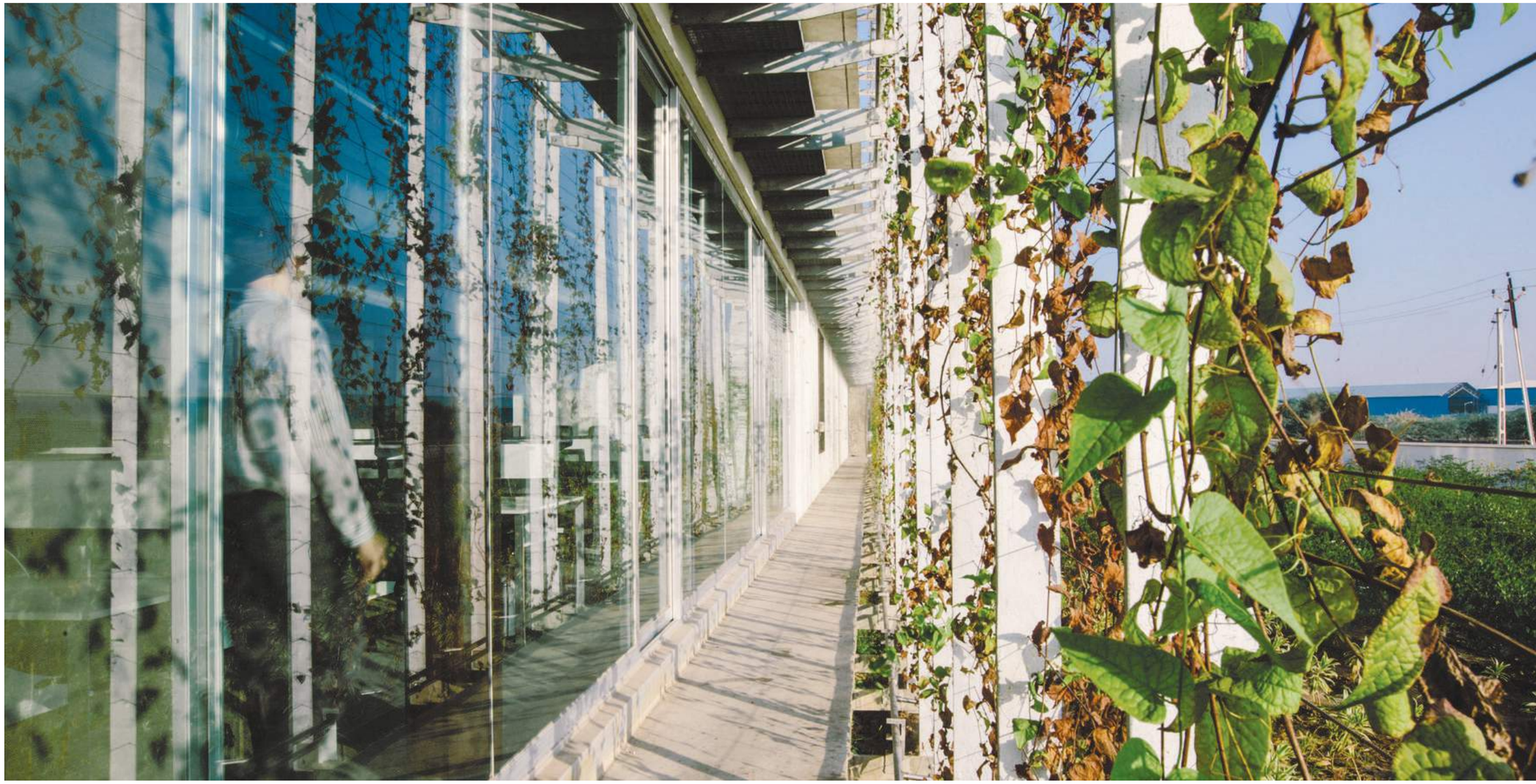
Details of misting system

Misting system in operation

GREEN WALL

The green wall is a vertically landscaped façade consisting of aluminium trellis panels upon which multiple species of flowering creepers grow. This organic external shading device is incorporated on the east, south, and north façades, so as to prevent direct solar heat gain in the adjacent office spaces.

According to the glass specification report of Saint-Gobain Glass, the green wall effectively reduces 30% of solar heat gain - thereby reducing the need for mechanical temperature control within the office.



ALUMINIUM FOUNDRY

The trellis panels are custom-made at an aluminium foundry in Coimbatore, Tamil Nadu.

The process of manufacturing a sand-cast component begins with pattern design and fabrication. The pattern is formed using a CNC machine. The input to the CNC machine is given through a computerised 3D model of the product. Therefore the pattern is an exact replica of the final design and also of the final product.

The pattern is subsequently used to make the mould in sand - a negative impression of the final product. For the process of sand-casting, a mixture of sand and coal is compacted in a metal tray. The sand used in the mould is obtained from either the sea or the river shore and has a certain amount of clay content that helps in binding of the material. A similar process is carried out using the opposite side of the pattern.

The final mould is formed by putting these two trays together, and holes are left in one of the moulds for pouring molten aluminium.

When heated to 750°C, the aluminium melts to form a red hot molten metal. Molten aluminium is poured using mild steel containers which have a much higher melting point. As the molten aluminium rapidly loses heat, the material is poured simultaneously at five points along the length of each mould. The obtained sand-cast panels are minimally machined to remove the excess aluminium and powder coated before final installation at site.

Images of the
aluminium foundry

06 RESOURCE EFFICIENCY

WATER

The manufacturing processes at the TeraSpin | A.T.E. factory do not require water. Hence water is only consumed for the use of employees and landscaping. In addition, efficient air-conditioning systems use water chillers and cooling towers to exhaust heat from indoor spaces to the outside. Since the site is spread over a large area, and water consumption is only restricted to a few areas, A.T.E. took on the challenge to make the TeraSpin site a net-zero water site, i.e. the site does not consume more water than it "produces", thereby reducing its footprint on the environment.

The designers developed a "water balance diagram" for the site to quantify the use of water in each area — water consumption. The size of the required air-conditioning system was aggressively reduced by incorporating passive cooling systems to reduce the heat load in the spaces to be cooled. The office building is rectangular with the south-facing sides smaller and without windows. The white mosaic roof reflects most of the solar radiation. The east and south walls have a "living" green façade that reduces solar heat gain. The factory building shades the major portion of the west wall.

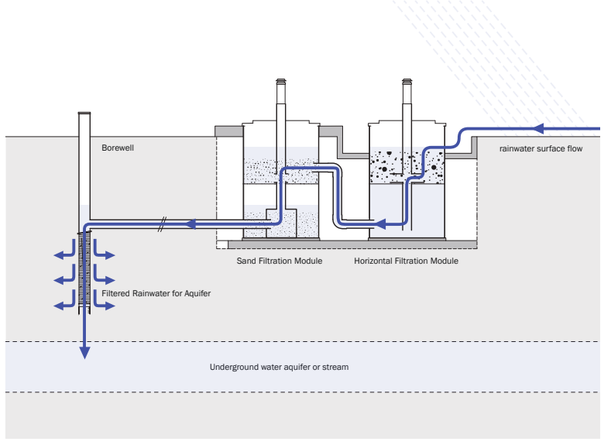
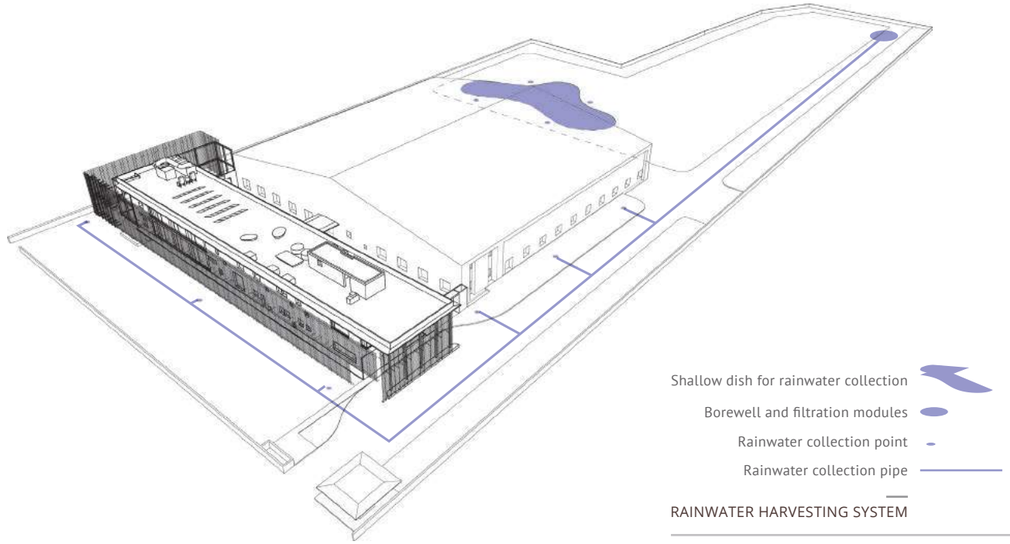


Diagram of borewell and filtration modules

In addition, the roof and other slabs in the office building are embedded with pipes filled with slowly-flowing water. The water in these "structural cooling systems" extracts heat from the building and dissipates it into the ground when the water is stored overnight. These measures reduce the power that may have been consumed by a larger air-conditioning system. Low-water fixtures are installed in wash areas, toilets and pantry areas to reduce water consumption. Finally, a sewage treatment plant with a state-of-the-art membrane-based ultrafiltration treats the water to remove all traces of chemical and biological impurities. The treated water is recycled for landscaping use.

A sophisticated rainwater harvesting system over the entire site collects rainwater from building roofs and paved areas, filters this water and then, recharges the ground.

Based on design calculations, the average water consumption on the TeraSpin site is estimated to be 7,500 m^3 annually, and the water "produced" by rainwater harvesting is estimated to be in excess of 8,600 m^3 — about 15% higher than that which is consumed.



RAINWATER HARVESTING SYSTEM

RAINWATER COLLECTION POINT

ENERGY

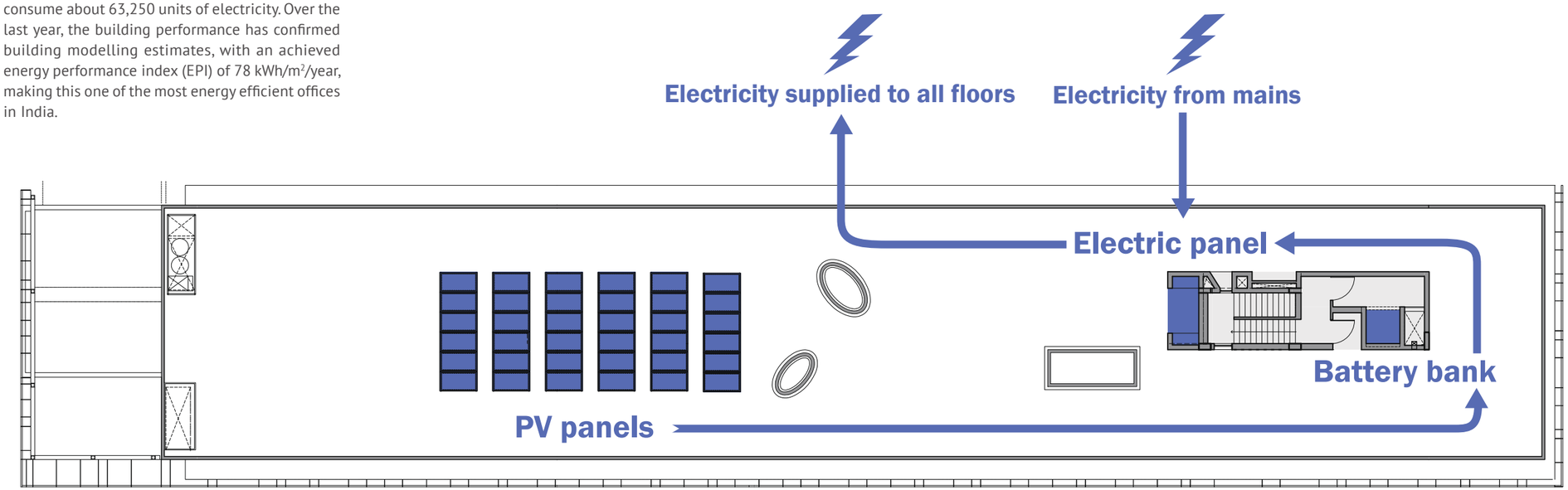
The TeraSpin | A.T.E. facility is designed with the highest standards of energy efficiency. Energy consumption in the production processes is continuously monitored and efforts taken to systematically reduce the energy consumed in the manufacture of each product.

The office is similarly designed with the motive to provide comfort as well as reduce the energy footprint. New technologies have been integrated to create a working environment that is comfortable as well as energy-efficient. The "mixed-mode" air conditioning system, which permits both natural ventilation and mechanical cooling, helps achieve the brief of a seamless working environment. The maximum temperature complies with the recommendations of ASHRAE's Adaptive Model of Comfort and is designed not to exceed 28°C inside the office space during the peak of Ahmedabad's summer.

Air-conditioning systems in an office building of this size in a hot and dry climate zone like Ahmedabad alone can consume more than 85% of the total energy used annually. The building design itself incorporates several features that reduce the energy consumed by the air-conditioners. Passive features such as the reflective mosaic roof and green wall on east and south façades reduce the energy spend by about 10%. Extensive use of day-light reduces energy use in lighting. Using LED fixtures instead of conventional lighting systems reduces the energy spend by another 1.5%. The unique structural cooling system also reduces energy spend by reducing the quantity of water lost by evaporation. The biggest energy reduction measures are the use of Ambiators. These machines based on novel indirect evaporation cooling technology can save more than 40% of the energy consumed by conventional refrigerant-based air-conditioners. Since the Ambiators work on fresh air, they ensure a healthy working environment with acceptable levels of carbon dioxide and free from odours. Ambiators are also an A.T.E. group product designed and built by A.T.E. | HMX.

Rigorous computer-building energy models estimate that these measures should help reduce the energy use intensity (EUI) by almost 40% from 145 kWh/m^2-year (46 kBTU/ft^2-year) to 90 kWh/m^2-year (29 kBTU/ft^2-year) and that the office building will annually consume about 63,250 units of electricity. Over the last year, the building performance has confirmed building modelling estimates, with an achieved energy performance index (EPI) of 78 kWh/m^2/year, making this one of the most energy efficient offices in India.

Diagram of the off-grid solar panel system



MONITORING SUSTAINABLE OPERATION

TeraSpin | A.T.E.'s desire is to continuously measure and verify various aspects of the building performance and operation to facilitate quantification of energy used and conserved. TeraSpin | A.T.E. also uses this system to monitor equipment manufactured / used by A.T.E. group companies for design verification. These aspects have been communicated by A.T.E. to EcoAxis, also an A.T.E. business unit, in a specification document. These aspects are broadly classified as:

1. Electrical energy consumed by lighting and factory loads.

2. Electrical energy consumed by cooling loads like Ambiators and structural cooling pumps.

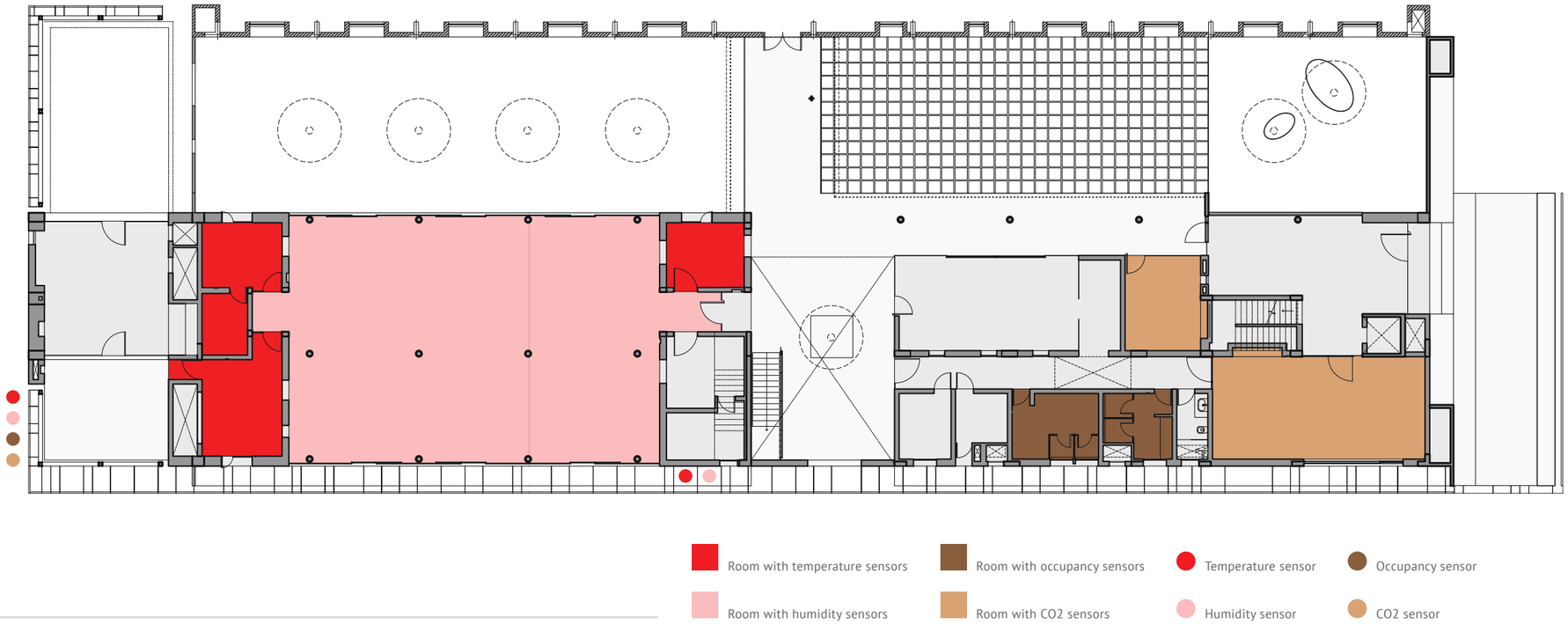
3. Indoor Air Quality (IAQ) parameters like CO2 levels, temperature and humidity at specific points in the factory and the office.

4. Water consumed and re-used in the facility.

The solution is broadly classified as hardware needed for data acquisition and a remote server based software for storing and viewing data, reports and notifications. The monitoring requirements proposed here-in cover parameters from an analytic perspective too.

The remote server hosts the software for data storage and display. The users can log on to the server using a standard web browser. They also get alerts and maintenance acts over SMS/email. (EcoAxis)

Environmentally monitored rooms on the Ground Floor



Ambiator panels

Structural cooling panels

Indoor air quality and occupancy panels

Panel for office monitoring

VPN over Internet

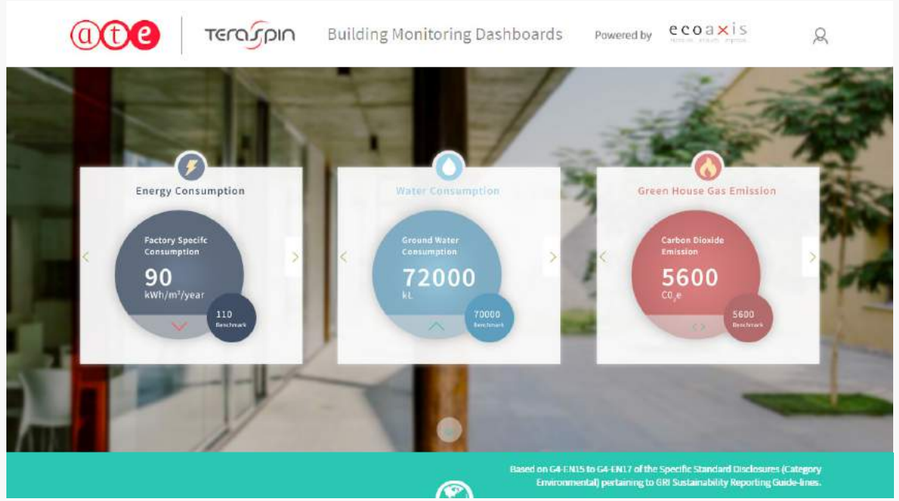
Office and factory user

Panel in pump house

Remote server

External user

Diagram of the monitoring system network



MATERIAL + TEXTURE

The TeraSpin | A.T.E. office at Sari is emblematic of the technology, structure and architectural elements used in the building, and this is achieved by exposing the systems wherever possible.

While the structural slabs of the building comprise exposed concrete resulting in an obstacle-free, low maintenance ceiling, an inverted structural system eliminates the need for false ceilings, which helps achieve maximum ceiling height.

An extensive amount of well-shaded glass has also been used in the building which helps maintain the openness of the office due to its transparent and unobtrusive nature. The columns inside as well as outside the building are made with weathered mild steel, yielding a rich texture. Other architectural elements such as protective boxes lining the openings and the furniture at the reception are also made using weathered mild steel, thus creating a consistent aesthetic across the office. The exposed nature of the structure increases visual porosity and encourages connectivity between the office and factory building.

SUSTAINABLE SYSTEM

Other special features of this LEED Gold-certified building are:

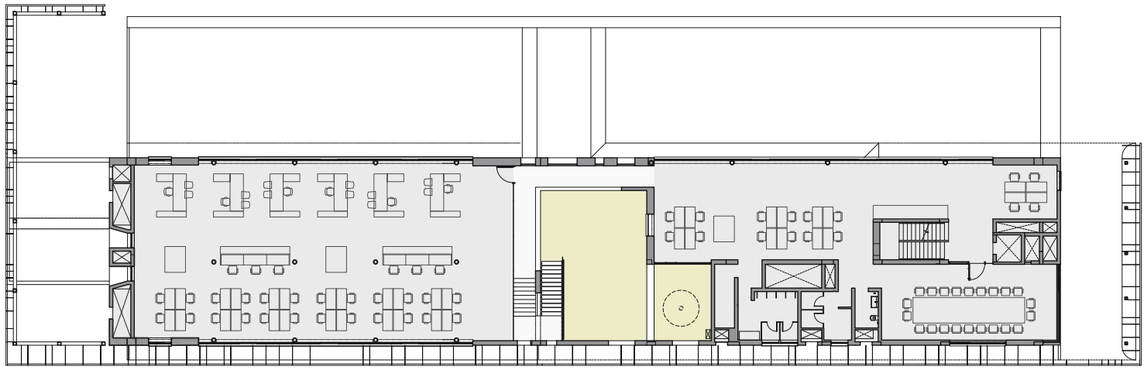
1. Extensive use of natural light in the facility.
2. Use of LED lights instead of regular lights. LED lights are more energy-efficient than CFLs.
3. Use of under-floor structural cooling to reduce the cooling load of the office.
4. Use of indirect evaporative cooling system consisting of Ambiators instead of solely using the conventional air-conditioning system. The combination of these technologies is referred to as 'hybrid' or fresh air air-conditioning.
5. Use of solar PV for power.
6. Rainwater harvesting on the site to prevent flooding and to replenish the groundwater.
7. Borewells as an important source of water.
8. An in-built sewage treatment plant.
9. Landscaped façade to block the heat and glare, hence cooling the micro-climate.

View of green wall with misting system

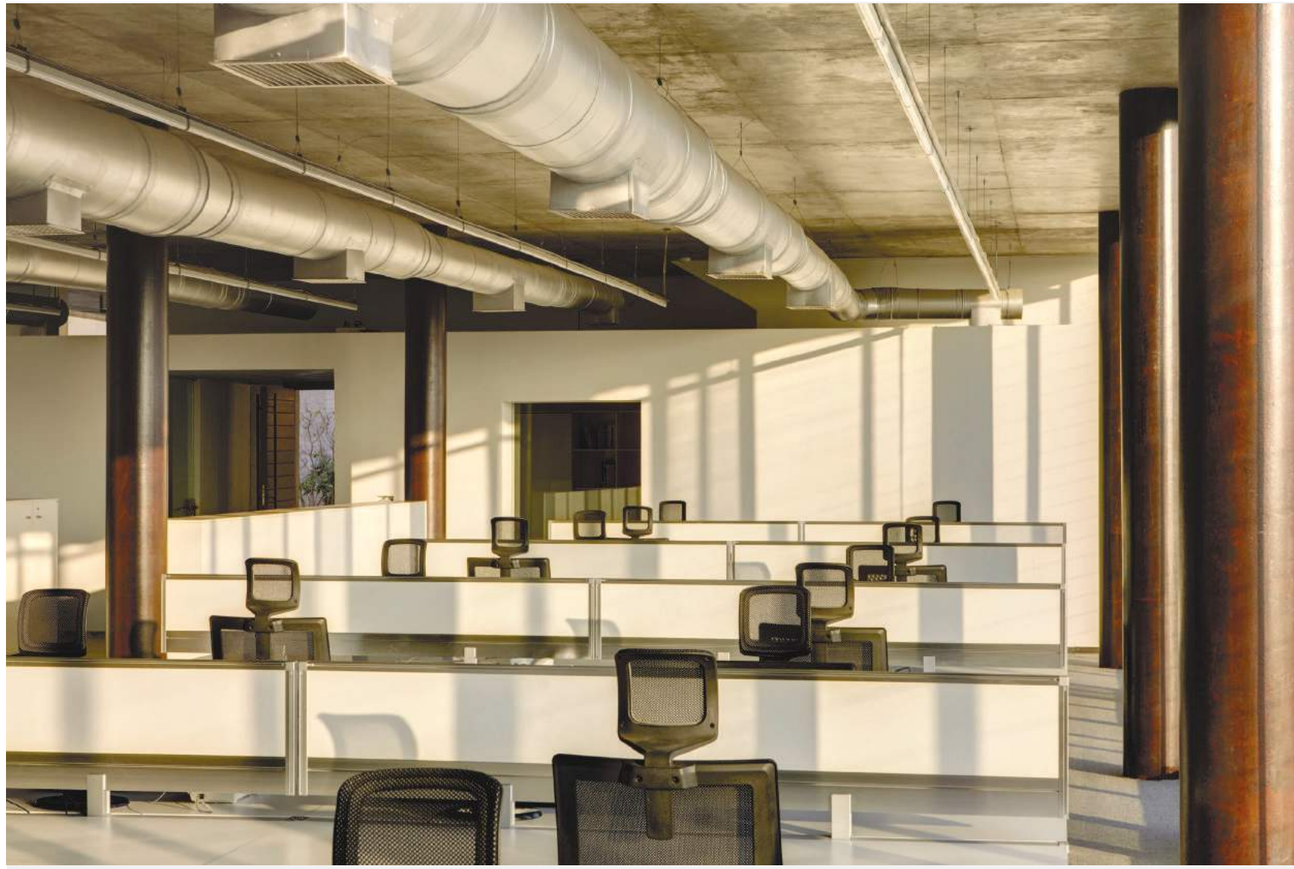
OPEN PLAN OFFICE

TeraSpin | A.T.E. consists of three large open plan offices-one on the ground floor and two within the proposed expansion space on the first floor.

An open plan office is one in which there are no vertical partitions between spaces for team members of different positions. Such a layout facilitates interaction as well as accessibility among colleagues. Open plan offices are also architecturally and experientially beneficial as the elimination of vertical partitions ensures that maximum natural light filters into the office. Air-conditioning of a singular volume with cross-ventilation, as opposed to multiple small, enclosed volumes also helps optimise the energy consumed by the air-conditioning system.



Open plan office layout
on the first floor



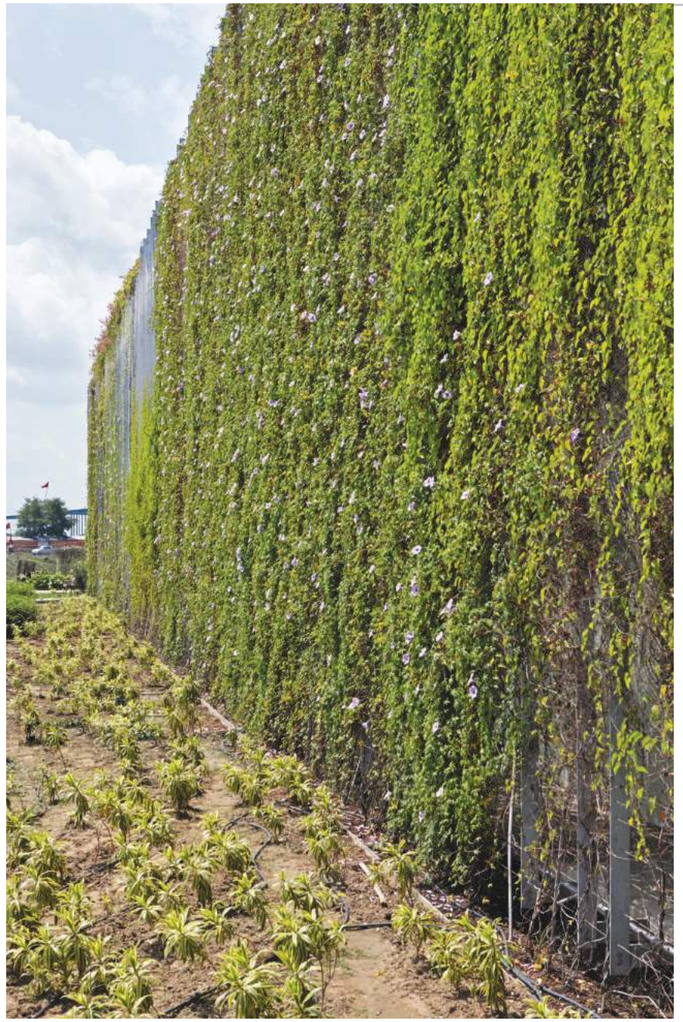
Interior view of office space

VERTICAL LANDSCAPING

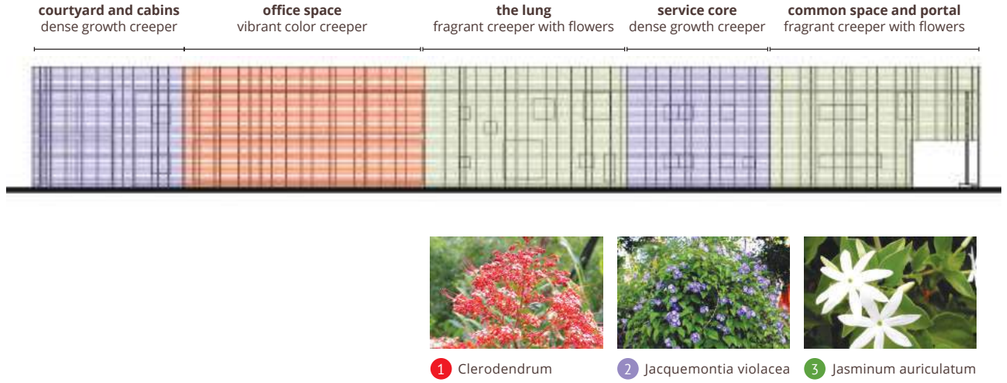
The green wall consists of three species of creepers that use the aluminium trellis panels and the horizontal stainless steel cables as climbing supports. The zoning of the species along the facade is designed in relation to the function of the adjacent interior spaces and the properties of the individual species. All three species used flower in different colours at different times of the year, thus creating a dynamic facade that is constantly in flux with seasonal changes. Jasminum auriticulatum bears white flowers that have a strong pleasing fragrance. Therefore the entry zone and the lung zone are lined with this creeper.

Jacquemontia violacea is a dense creeper with blue flowers. The violacea is used along the service areas, i.e. the toilets and pump room, to ensure privacy of these spaces.

Clerodendrum bears vibrant red flowers. This species is located adjacent to the open office spaces as the red flowers enrich the atmosphere in these work spaces.



Detail of Jacquemontia violacea creeper



Creeper species in relation to programs within

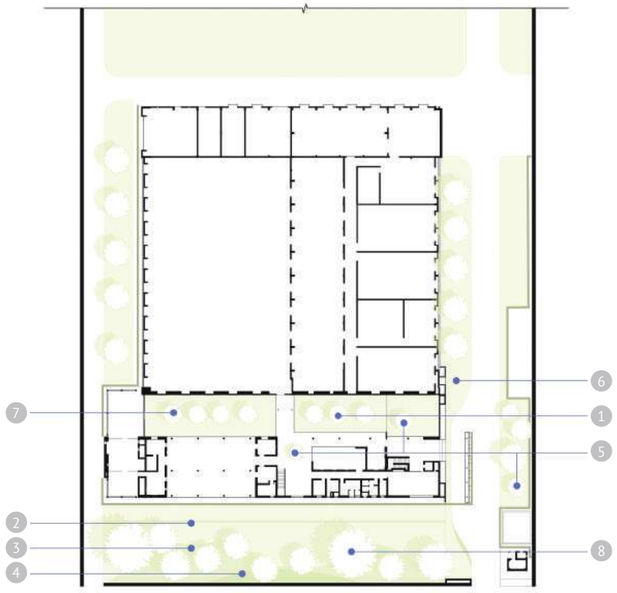
INDIGENOUS PLANTS

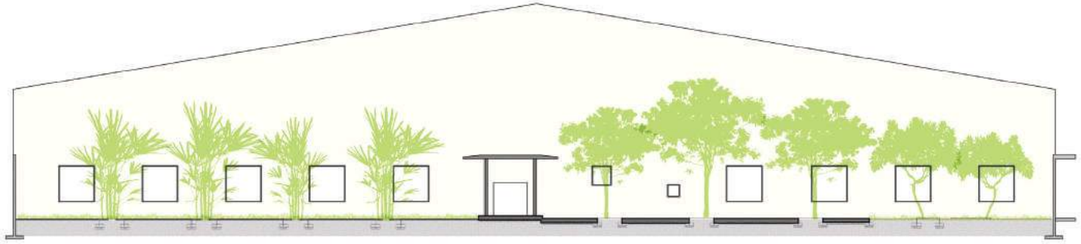
The TeraSpin | A.T.E. office is oriented so that the long faces of the building face the east and west. Both the long edges of the building are adjacent to large landscaped patches which yield a cooler micro-environment. This is achieved by shading a considerable amount of the site using trees and ground cover, which reduces the heat gain by the surfaces and thus the load on mechanical and electrical systems.

The landscape in front of the building is a combination of tall grasses/ground cover and two types of trees. Tall rain trees are positioned along the edges so that the sunlight is not blocked and shorter pelophorum trees are interspersed in the middle.

The courtyard adjacent to the open office is planted with tall table palms which are more sculptural in nature. The paved courtyard, adjacent to the cafeteria and passage is lined with peltophorm trees that form a shading canopy and allow for the courtyard to be used even during the afternoon hours. A courtyard adjacent to the reception consists of two elliptical planters with champas that are more ornate in nature.

All species used in landscaping the site are indigenous in nature. This not only reduces procurement and transportation costs, carbon footprint, and water consumption, but also ensures a better chance of the plants growing well and remaining healthy.





Section across courtyard

1 Peltophorum tree

2 Lemon grass berm

3 Amaryllis lycoris

4 Red Exora

5 Champa tree

6 Carpet grass

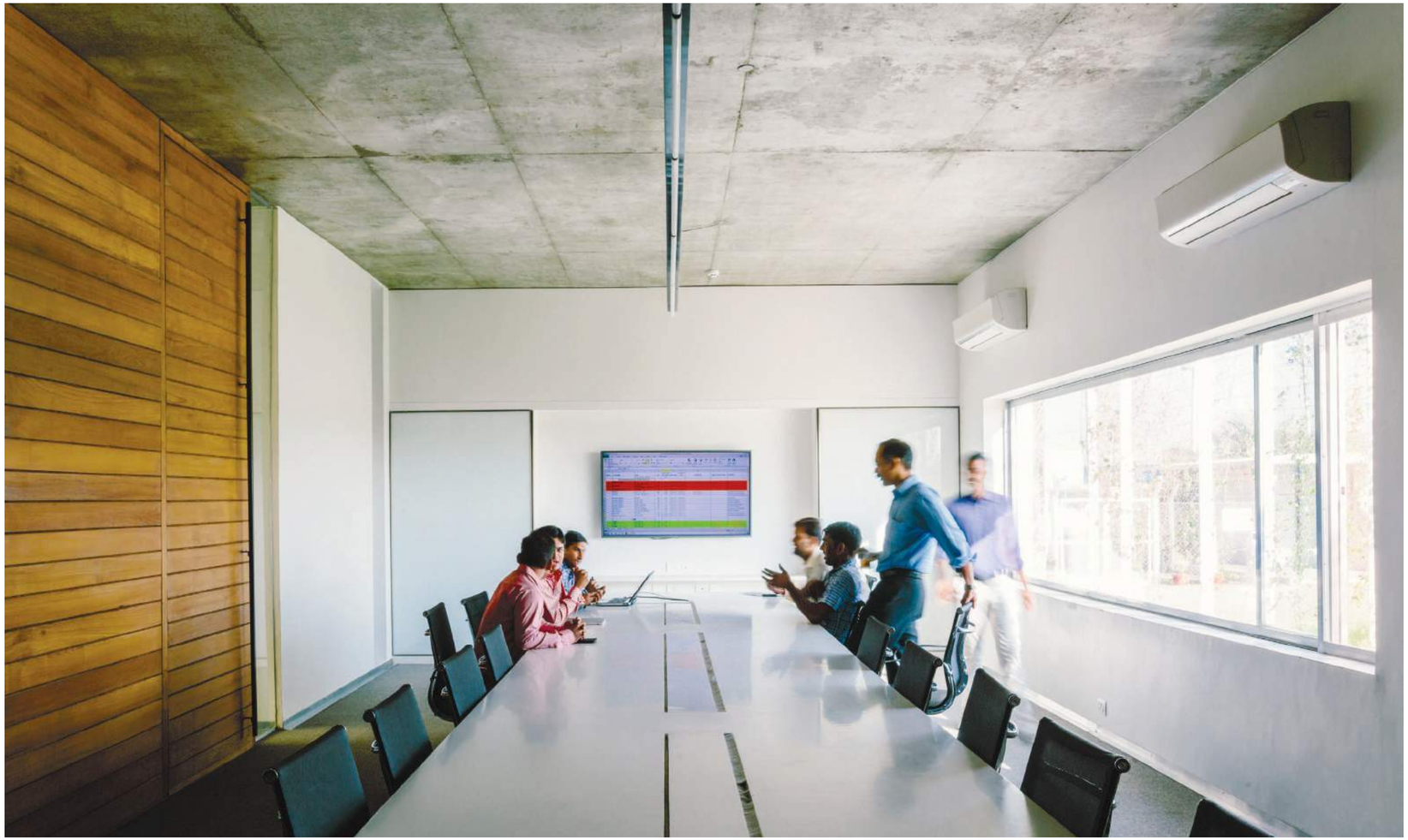
7 Rhapis palm tree

8 Sheesham tree

Indigenous plant species throughout the site

08 TEAM WELL-BEING

As the pace of technological innovation intensifies and human beings are asked to process more information and perform increasingly complex tasks, it becomes exceedingly important for architectural design to respond to these needs. Building design is a critical tool in the promotion of societal health and well-being, yet there remains a radical disconnect between the physical expectations placed on modern workers and the architectural response to such demands. A thoughtfully designed space can increase productivity, foster a sense of community, and minimise environmental impact. The minimal design ensures comfort, while the use of Ambiators and green, open spaces ensures plenty of healthy, fresh air.



USER COMMENTS

"I am glad to be part of this green building which is good for the environment and saves energy for the nation. It is a real case of practicing what we preach in our corporate environment policy."

- Nitin Jangid, Operations Executive

"I like that inspite of working in an office we have fresh air and natural light and the temperature is comfortable even during summers. Don't know how it works but the special bricks used to construct the building seem to make a difference too."

- Shailen Shah, Sr. Accounts Officer

"Having worked in air conditioned offices for several years, I have experienced a slight headache towards the end of the day, say around 4 pm. This does not happen at all in the TeraSpin premises. My background in HVAC helps me to appreciate this even more and am glad to be breathing fresh air all day. Being in natural light all through the working hours is another privilege that I enjoy in TeraSpin."

- Kamal Kulshreshtha, General Manager - Business Development

"The working comfort in the Sari office building resulting from the fresh & clean air all the time for breathing, natural sun light for working during the day hours and the surrounding green environment is indeed excellent. Overall working environment resembles more with a world-class learning institution than a manufacturing unit."

- K P Singh, Director, Head of TeraSpin

09 **CONCLUSION**

The TeraSpin | A.T.E. office, while being an autonomous intervention on the site, has been successful at two levels:

Firstly, it has integrated the existing factory on the site itself, allowing visitors to view the factory-office complex from the main road. The liberal use of landscaping, including the green wall façade, has fluidly embedded the factory, and now the office, into the surrounding landscape.

Secondly, the building serves as an apt representation of the values of the A.T.E. group of companies, reinforces its commitment to the health and comfort of its team, fosters social interaction among its employees, and demonstrates the range of products that A.T.E. is engaged with.

In this sense, the TeraSpin | A.T.E. office is an appropriate response to multiple aspirations, both at the level of the site as well as spatial delineation.

TECHNICAL DESIGN

SITE	Location	Sari village, Sanand taluka (30 km from Ahmedabad)
	Latitude - Longitude	23.1°N - 72.6°E
	Climate	Hot and dry
	Total area	5.1 acres
BUILDING	Building type	Office next to factory
	Office area	19,700 ft^2
	Factory area	40,500 ft^2
	Design occupancy of the office	75
PRODUCTS MANUFACTURED	Textile spinning components	High-speed spindles, drafting systems and top rollers for ring frames and speed frames
GREEN FEATURES	Energy efficiency	Natural lighting (openings and fenestrations, skylights)
		Building shadings
		LED lights
		Reflective office roof
		Low-ε coating on factory roof
		Structural cooling system
		Multiple evaporative cooling systems: total capacity more than 143,000 cfm
	Water efficiency	Rainwater harvested on entire site, 10,000 lpd sewage treatment plant
	Enhanced Indoor Air Quality (IAQ)	Cool and fresh air supply, passive ventilation, CO2 monitoring, plants
	Energy Performance Index (EPI)	78 $kWh/m^2/y$ in occupied area of office building (measured)
	Building certification	LEED Gold certification

DESIGN TEAM

Client	TeraSpin, A.T.E. Enterprises Pvt Ltd
Design Architects	RMA Architects Pvt Ltd / Mumbai + Boston Rahul Mehrotra, Robert Stephens, Palak Jhunjhunwala, Prashant Saudagar
Structural Consultant	Vijay K. Patil & Associates
Services Consultant	SMPS Consultants
Interior Design	Anisha Modi
Civil Contractor	Keya Associates
Interior Contractor	Nirmiti
Landscape Contractor	Rahul Harishchandra
Building Modelling	Corporate R&D, A.T.E.
Structural Cooling	Pan Asia Engineers Pvt Ltd
Cooling Systems	HMX, A.T.E.
Water Systems	Flow Technology Group, A.T.E.
Water Treatment Systems	A.T.E. Envirotech Pvt Ltd
Remote Monitoring	EcoAxis, A.T.E.