Climate Risk Assessment

Framework: TCFD-aligned, IPCC-based | Scenario: SSP5-8.5

1. ABREL's Approach to Climate Risk Assessment

ABREL's climate risk assessment framework is designed to be both scientifically robust and operationally relevant. It integrates scenario modelling, on-ground risk mapping, and design resilience reviews to ensure that every project, whether upcoming or operational, adheres to high standards of climate preparedness.

1.1 Climate Scenarios Applied

All assessments use the IPCC's Shared Socioeconomic Pathways (SSPs):

Scenario	Temp Range	Description
SSP5-8.5	3.3-5.7°C	Fossil-fuelled development with rapid economic growth. Used as worst-case scenario for ABREL's screening.
SSP2-4.5	2.1-3.5°C	Middle of the Road scenario; socioeconomic and technological trends follow historical patterns.
SSP1-2.6	1.3-2.4°C	Sustainable development pathway; global shift towards a more sustainable trajectory.

The SSP5-8.5 scenario is applied as the primary screening tool, representing the most adverse plausible future and ensuring that resilience measures are designed for worst-case conditions.

1.2 Assessment Methodology: Six-Step Process

Step 1: Data Collection

Collection of site-specific data from each residential and commercial project, including geographic, hydrological, and meteorological parameters. Primary data is gathered from project-specific surveys; secondary data is sourced from verified government databases including BMTPC, CGWB, IMD, and WRI Aqueduct.

Step 2: Climate Scenario Modelling

Risk assessments are conducted using internationally recognised SSP modelling frameworks. These provide future climate projections to evaluate both acute and chronic risks under multiple temperature rise pathways through near-term (2015-2040) and mid-term (2041-2070) periods.

Step 3: Identification of Major Risks

ABREL assesses key physical risk categories relevant to each site, including flooding and stormwater run-off, water scarcity and groundwater criticality, urban heat island effect and heat stress, cold extremes, precipitation variability, and cyclone and wind exposure.

Step 4: Assessing Adaptive Capacity

For each site, the inherent resilience or adaptive capacity is evaluated based on factors including site elevation, drainage design, ventilation strategies, landscaping approaches, material specifications, and available backup systems.

Step 5: Integration of Resilience Measures

For upcoming projects, findings directly shape the design brief. For operational assets, findings confirm that resilience measures are in place. Risk findings are classified by stage: Land Stage, Construction Stage, and Operational Stage, with Capex and Opex categorisation applied to all recommended measures.

Step 6: Risk Evaluation and Corrective Actions

Each identified risk is analysed for severity and probability, and matched against the project's current mitigation features. Where required, corrective design or operational measures are proposed and tracked through to implementation.

1.3 Data Sources by Risk Category

Risk Category	Data Sources
Flood	BMTPC Vulnerability Atlas, City/District Disaster Management Plan (C/DDMP), District Irrigation Plan (DIP), News Articles
Cyclone	BMTPC Vulnerability Atlas, C/DDMP, News Articles
Surface Water Stress	WRI Aqueduct Water Risk Atlas, DIP
Groundwater Criticality	Central Ground Water Board (CGWB) database, News Articles
Drought	C/DDMP, DIP, News Articles
Temperature & Precipitation	Copernicus Climate Data Store, Visual Crossing, IMD Data Service Portal, QGIS

2. Physical Risk Assessment: FY 2025-26 Projects

In FY 2025-26, PCRS assessments were conducted across all active residential & commercial projects. Each site was evaluated against acute and chronic hazard categories under SSP5-8.5.

2.1 Acute Risk Categories Assessed

- Flood (Inland Flooding, Coastal Flooding)
- Cyclone and Wind (including BMTPC wind hazard zone classification)
- Surface Water Stress (WRI Aqueduct rating)
- Groundwater Criticality (CGWB over-exploited/critical zone classification)
- Drought (historical drought frequency and DDMP classification)

2.2 Chronic Risk Categories Assessed

- Extreme Temperature and Heat Waves (hot days >35°C, warm days >25°C projections to 2041-2070)
- Precipitation Variability (annual rainfall, extremely wet days, very heavy precipitation days)
- Heat and Water Stress (combined temperature and water availability assessment)
- Coastal Flooding Exposure (proximity to sea; sea level and storm surge risk)

3. Resilience Measures Across Portfolio

Each project underwent a comprehensive resilience diagnostic. Measures are structured by implementation stage (Land, Construction, Operational). The following reflects the consolidated measures & mitigation toolkit for each type of risk:

3.1 Flood and Surface Water-

Land Stage

- Elevated plinths and podiums
- Peripheral stormwater trenches and detention ponds with slope-based discharge design
- Natural drainage pattern preserved during site levelling; alternate drainage lines provided where natural channels are disrupted.
- Green infrastructure: landscapes and bioswales
- Silt fences and sediment barriers around site perimeter and downslope areas

Construction Stage

- Temporary site bunds and stormwater sumps
- Geo-textiles and silt fences to control erosion
- Stormwater directed to existing channels with silt traps; direct discharge of construction wastewater avoided
- Soil stockpiles covered with tarps or plastic sheeting
- Overflow containment in rainwater tanks
- Construction activities limited during heavy monsoon periods
- Labour camps, temporary offices, and electrical units positioned at elevation
- Flood preparedness drills with designated assembly points

Operational Stage

- Stormwater drains re-engineered using 50-year rainfall data
- Backflow prevention devices on drainage outlets
- Permeable landscaping: pavers with sand joints and grass-crete in driveways and parking areas
- Rainwater harvesting system with recharge pits for groundwater replenishment

4.2 Heat and Urban Heat Island

Land Stage

- Cross-ventilation strategies embedded in design layout and building orientation
- Tree cover and shaded pedestrian pathways across site
- High albedo road surfaces to reduce heat absorption
- Green buffer zones integrating native species

Construction Stage

- Reflective roofs: China mosaic or high Solar Reflectance Index (SRI) finishes
- Optimised glazing: U-values 1.98-5.6 W/m^2K; low SHGC glass (<=0.3)
- Openable windows covering 8-10% of floor area for natural ventilation
- Thermal-insulating facade materials
- Altered work shifts to cooler morning and evening hours during peak summer
- Shaded rest zones and dedicated hydration points for construction workers
- Periodic health check-ups for labourers during heat stress periods
- Energy-efficient cooling systems with variable-speed drives

Operational Stage

- Thermal reflective coatings on roofs
- Green infrastructure covering 20-30% of site area (lawns, planting, bioswales)
- Native vegetation planting to mitigate heat island effect

4.3 Wind and Cyclone

Land Stage

- Pre-acquisition Environmental Impact Assessment (EIA) with focus on wind vulnerability, flood modelling, and soil erosion
- Preservation of natural cyclone barriers (existing vegetation, natural landforms)
- Hazard mapping with rounded peripheral corners on building footprints for improved aerodynamics

Construction Stage

- Double-glazed facades engineered for high wind loads
- Structures rated to withstand wind speeds exceeding 120 km/hr
- Solar panels anchored and anchor-tested to withstand design wind loads
- Cyclone shelters positioned on elevated areas of site
- Adequate backup power systems positioned above design storm surge level
- Tower crane usage restricted during heavy wind and rainfall events

Operational Stage

- Periodic structural inspection of facades, anchors, and panel fixings
- Emergency Response Plans aligned with District Disaster Management Plans (DDMPs)

4.4 Water Stress and Drought

Land Stage

- Seasonal CGWB groundwater monitoring before and during construction
- Groundwater recharge pits and percolation tanks
- Clay-lined retention ponds for stormwater capture
- Hydrogeological assessment to understand aquifer recharge potential
- Xeriscaping and drought-resilient plantation with native species
- Zero-discharge landscape design

Construction Stage

- Curing compounds used in place of water curing where feasible
- Concrete wash water treated and reused for curing and dust suppression
- Modular and precast construction methods to reduce on-site water demand
- Rainwater harvesting via temporary collection tanks on site
- Surface runoff reused after filtration; direct drainage discharge avoided
- Strict tanker sourcing protocols: licensed vendors only
- Daily water source and consumption tracking

Operational Stage

- Bioswales and landscape for integrated water management
- Treated greywater reuse for landscaping and flushing (coordination with municipal authorities)
- Water-efficient drip irrigation with weather-based smart controllers
- Disconnection of hardscapes from direct discharge to stormwater drains

5. Transition Risk Assessment

In FY 2025-26, ABREL deepened its climate-transition readiness through the Carbon Risk Real Estate Monitor (CRREM) framework, aligned with the Paris Agreement's well-below 2°C scenario. The assessment covered all currently owned and recently completed commercial and residential assets across Mumbai, Bengaluru, and Gurugram, forming part of ongoing efforts to align with the Aditya Birla Group's Net Zero 2050 ambition.

5.1 CRREM Assessment Process

1. Portfolio Data Collection: Relevant data on all properties gathered, including energy consumption, building characteristics, location, and market data.
2. Carbon Footprint Estimation: The carbon footprint of each property calculated by assessing operational energy consumption and associated carbon emissions.
3. Scenario Analysis: Assets evaluated against science-based decarbonisation trajectories aligned with the Paris Agreement's well-below 2°C target.
4. Risk Assessment: Financial and physical risks analysed, including risks from regulatory changes, technology transitions, energy price volatility, and market demand shifts.
5. Portfolio-Level Aggregation: Results aggregated to assess overall carbon intensity and transition risk across the portfolio; high-risk assets identified and mitigation actions prioritised.

5.2 Key Insights from CRREM Analysis

- Benchmarking Against Global Pathways: Carbon intensity of each asset was evaluated against the Paris Agreement 1.5°C scenario decarbonisation trajectory. This identified specific assets and asset classes where emissions performance must improve to remain within future carbon budgets.
- Early Exposure for Commercial Assets: Commercial assets are expected to encounter transition-related stranding risk earlier in their lifecycle, highlighting the importance of timely operational efficiency improvements and renewable energy sourcing decisions.
- Longer-Term Residential Trajectory: Residential properties currently align with decarbonisation benchmarks but their projected carbon trajectories indicate a need for planned efficiency improvements over the coming decade as pathways tighten.
- Certification Baseline: All assessed assets hold IGBC or LEED certification, providing foundational preparedness for transition resilience and a credible platform for further improvement.