200 Park Avenue, formerly the Pan Am building, stands at one of the great urban crossroads: the intersection of Park Avenue and 42nd Street, with a 59-story tower standing atop and connected into the pedestrian circulation system of Grand Central Terminal. Designed by Walter Gropius and Pietro Belluschi in a bland mid-century modernist style, the controversies over its construction over half a century ago have long since faded, and the building has become an imperturbable fact – looming, but not much noticed, and certainly not much admired.

And yet... one wonders if there is anything to be salvaged, whether with some deft interventions the building can be transformed into something that might do for 21st century Manhattan what Grand Central Terminal itself did for the 20th century, namely, provide a memorable experience of soaring public space situated in the heart of the city. In the context of our present environmental challenges, such a transformation would also have to greatly reduce energy consumption and carbon emissions; and, as would be appropriate, the design should express our aspirations for a sustainable future.

Broadly considered, the building facade is a mediating element: between public and private realms; between interior and exterior environments; and between urban and human scales. In working through and reconciling these sometimes conflicting considerations, the design takes on a specific character. At the urban scale we have striven to make readable on the facade an idea about the particular location of this building in mid-town Manhattan. We have also strategically re-shaped the tower to repair some of the damage that was done to the skyline as viewed from both ends of Park Avenue by the construction of the Pan Am building in the first place. At the building scale we have re-invented the form, the spatial experience, and the image/identity of the building while retaining in its essence the composition of the original design. At the facade scale we have developed a cladding system that significantly improves energy performance and enhances the workplace environment. Finally, we have created amenity spaces that take advantage of unparalleled urban vistas for enjoyment by the building users as well as by the general public. All of these interventions have been made without a loss in leasable square footage, by harvesting space from the reduction in the size of mechanical systems – an example of just one of the synergies that stem from the design of an exceptionally energy efficient facade.

We believe that our approach is applicable on a broader scale to many under-performing high rise buildings.

It is our conviction that the responsibility to minimize energy consumption and carbon emissions in our built environment comes with an equal responsibility to achieve the highest standards of design. In our submission for the Metals in Architecture competition, we have lowered the present annual energy consumption of the building by 70 percent, and by 74 percent as compared to the median New York City office building.
**SCALE: URBAN**
- Sky Park at building top links Grand Central with an urban green space for the 21st century
- Sky gardens extend Park Avenue vertically up the South facade
- Horizontal separations at mechanical floors are accentuated and re-visioned as greenbelts

**SCALE: BUILDING**
- Sky Park, greenbelts, and sky gardens provide a connection to the natural environment
- Solar backbone and greenbelts let building breathe and reduce cooling load
- Express elevators to Sky Park create a vertical avenue up the North facade

**SCALE: FACADE**
- Double-skin maximizes envelope performance
- Solar hot water collectors at spandrels drive absorption chiller
- PV panels integrated into solar shading fins generate power
- Light shelf fosters daylight autonomy
At the time it was constructed, the Pan Am building was widely criticized for creating an obstruction that blocked the sky above Park Avenue and that, by towering above, diminished Grand Central Terminal’s urban presence.

An underlying principle behind our scheme is to re-establish the continuity of Park Avenue by extending the “virtual avenue” up the center portion of the south façade as a green strip, comprised of a series of 3-story Sky Gardens intended as an amenity for the building’s users. The green façade strip culminates in a Sky Park at the top of the building, housed in a new glass enclosure constructed on the former helicopter landing pad. The Sky Park, open to the public, is reached by means of a pair of room-size glass enclosed express elevators that depart from the existing 45th Street lobby and which rise up the north side of the building in a new glass shaft that doubles as a solar chimney (the “Solar Backbone”). The movement of the elevators on the north side of the building can be seen as the vertical expression of the dynamism of Park Avenue North’s automobile traffic.

A second underlying principle is that there must be a link that initiates an urban conversation with Grand Central Terminal. Among Manhattan skyscrapers, 200 Park Avenue is uniquely situated on the axis of a major avenue and above a major transportation hub. The expansive Sky Park, with unparalleled vistas up and down Park Avenue as well as views east and west, offers an aerial counterpart to Grand Central’s Main Concourse. The existing pedestrian connection between Grand Central Terminal’s entrance at 42nd Street and the 45th Street lobby – one of the most traveled indoor thoroughfares in Manhattan – now has a vertical counterpart. Two monumental public spaces offering very different experiences of the city are now woven into a complex that celebrates the intersection of transportation infrastructure and sustainability.

As an iconic gesture to Manhattan’s skyline, and as the symbol of 200 Park Avenue’s exemplary energy efficiency, the Sky Park culminates with a spire extending aloft from the solar chimney, completing the ensemble and marking the building’s presence on the skyline, visible for miles.
RECLAIM SPACE FOR GREEN AMENITY, REDUCE MECHANICAL AREAS

CREATE: SKYGARDENS AND SKY PARK

GAIN: ELIMINATE PERIMETER HEATING TO GAIN USEABLE FLOOR AREA

INSULATE: CLAD EXTERIOR FACADE WITH DOUBLE SKIN AND SOLAR CHIMNEY

ORIGINAL PARTI SKETCH: NORTH FACADE

URBAN EXPERIENCE

GRAND CENTRAL TERMINAL

SOLAR CHIMNEY

SOLAR BACKBONE

SKY PARK

GREENBELT

ELEVATORS TO SKY PARK

SKY GARDENS

OPEN: RECLAIM SPACE FOR GREEN AMENITY, REDUCE MECHANICAL AREAS

CREATE: SKYGARDENS AND SKY PARK
SUSTAINABILITY

Sustainability is woven into our design thinking. Wherever possible we have layered architectural purpose over what otherwise would be purely technical measures to increase energy efficiency.

In developing a strategy for introducing natural ventilation, we used the three existing mechanical floors that are articulated as recesses in the façade to take in fresh air. We are able at the same time to significantly increase the depth of those recesses, having reduced the size of mechanical equipment through our energy strategy. We have also increased the height of the recesses by removing a portion of a floor above with no net loss of leasable space, again due to reduced area for mechanical systems. The result are airy double-height outdoor Greenbelts, with trees and plantings, which can be enjoyed by building occupants during warmer weather.

Between every fourth floor in the Green Strip – the middle portion of the south façade – two floors have also been partially removed to create a series of fifteen foot deep, 3-story high Sky Gardens equipped with a solar screen of deciduous vines that will block or allow solar energy to enter the space depending on the season. From an energy perspective the space functions as the unconditioned cavity of a deep double façade, with natural ventilation in warmer weather, and passive solar heating in the winter. Building users can enter the Sky Garden at intermediate floor levels via balconies.

The Sky Park at the top of the building is also unconditioned and naturally ventilated, with a combination of solar shading and vegetation to maintain comfort. The glass roof of the Sky Park is laminated with thin film photovoltaic cells. Arriving visitors will be able to experience a permanently installed interactive exhibit explaining the building’s energy efficient features that will provide real-time readouts of energy performance.

The cap of the Solar Backbone is a multi-story glass chamber containing black ceramic heating elements that absorb solar energy. By increasing the temperature differential the heated ceramic elements induce the air that enters the building at the Greenbelts to flow upwards at a higher rate. Louvers at the very top release the heated air.

From our solar radiation studies we found that 200 Park Avenue receives an unusual amount of insolation due to its height and its unique position on axis with Park Avenue. We developed facade solutions that are responsive to orientation, exposure, and season.

These various elements can all be seen as both technical components of an energy strategy and as the expression of architectural features that re-vision the building for a sustainable twenty-first century.
1. Existing precast verticals and spandrel panels to be retained, windows to be removed
2. Unitized double skin curtain wall panel with vision, spandrel and clerestory zones
3. PV panel mounted on the exterior, angled to receive solar energy
4. Dynamic shading in the cavity to control heat gain at the vision zone
5. Evacuated tube solar collector in the cavity provides hot water to the absorption chiller
6. Light shelf at clerestory zone to allow daylight penetration deeper in the floor plate; localized glare reduction at vision zone
7. Maintenance walk with perforated and reflective surface to allow air flow and extend light shelf
SOLAR CHIMNEY
Operable glass louvers to exhaust or store heat depending on the season
Pin-supported cable-net facade with intermediate horizontals
Glass roof to permit penetration of solar radiation
Ceramic collectors absorb heat and induce stack effect

DOUBLE FACADE II
Unitized and sealed double skin curtain wall panels with integral dynamic shading in the cavity
Existing precast verticals and spandrel panels to be retained, windows to be removed

EVALUATING THERMAL PERFORMANCE
NORTH FACADE ANALYSIS USING THERM

SUNLIGHT
INTAKE AIR
EXHAUST AIR
SKY GARDENS

Three-storey untempered space provides a thermal buffer and allows occupant use, while maintaining a temperature range between 65-75 degrees for most of the year.

1. Pin-supported facade with vertical glass fins
2. Horizontal louvers with operable damper to control outside air intake / exhaust
3. Openings low for intake air alternate every other bay with openings high for exhaust air
4. Evacuated tube solar collector in the cavity provides hot water to the absorption chiller
5. Ivy growing on tension cables provides natural solar control by blocking harsh summer gains and shedding its foliage to allow heat gains in the winter.
Achieving the 2030 Challenge requires a whole-building approach. Modifications to the façade alone cannot act in isolation to meet 2030 energy reduction targets. In this light, our concept develops the façade as a catalyst to:

1. Reduce loads
2. Enable high efficiency systems
3. Generate energy

Improvements to the façade reduce both heating and cooling loads. The curtain wall spandrels incorporate vacuum insulated panels, significantly increasing their R value as compared to a conventional façade. The glazing includes a high-performance thermally broken mullion, IGUs with a high-performance low-E coating, argon fill and warm edge spacers. By creating a buffer zone, the proposed double-skin façade improves the U value as compared to the existing façade from 1.23 Btu/hr ft² °F* to 0.13 Btu/hr ft² °F**. If the cavity of the double-skin is closed during the winter, the greenhouse effect increases the thermal performance by approximately 30%. Therefore the final combined U-value of the double-skin during winter is reduced to 0.09 Btu/hr ft² °F.

The curtain wall units are angled to create a shading device to reduce solar heat gain and act as a light shelf to increase daylight. Low-iron glass increases the Tvis and improves daylighting. The double-skin enables integration of dynamic venetian blinds in the cavity controlled through daylight sensors, further improving solar control and daylight autonomy. The new solar chimney (the Solar Backbone) also reduces cooling loads by facilitating natural ventilation through stack effect.

This re-visioning of the façade sets the framework for upgrades to high efficiency building systems. Most significantly, the improved performance of the exterior wall enables the installation of active chilled beams for heating and cooling. Chilled beams are highly efficient but cannot function effectively without a high performance envelope and sufficient air-tightness to control humidity - our proposed façade meets the criteria to allow for this. Improved daylight harvesting in the new façade design also supports the use of a perimeter daylight dimming system with upgraded LED lighting. We have also assumed a reduction in equipment power of 45% due to efficiency and utilization trends in office equipment.

Finally, our proposed façade design integrates photovoltaic modules and solar evacuated tube collectors that generate electricity and hot water. The solar hot water substantiates the use of an absorption chiller, reducing the building’s cooling energy use by 45%.

By designing a façade that reduces loads, enables use of efficient systems, and generates energy, our project has reduced the building’s PEUI to 30.5 kBtu/sf/yr from an existing EUI of 150 kBtu/sf/yr.

---

### ENERGY CONSERVATION MEASURES

<table>
<thead>
<tr>
<th>Measure</th>
<th>EXISTING TOTAL ENERGY USE</th>
<th>PROPOSED TOTAL ENERGY USE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>39% IMPROVEMENT</strong></td>
<td><strong>10% IMPROVEMENT</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td><strong>78.9%</strong></td>
<td><strong>79.7%</strong></td>
</tr>
<tr>
<td><strong>Lighting</strong></td>
<td><strong>14.1%</strong></td>
<td><strong>12.1%</strong></td>
</tr>
<tr>
<td><strong>Refrigeration</strong></td>
<td><strong>7.9%</strong></td>
<td><strong>7.9%</strong></td>
</tr>
<tr>
<td><strong>Hot Water</strong></td>
<td><strong>4.1%</strong></td>
<td><strong>5.5%</strong></td>
</tr>
<tr>
<td><strong>Cooling</strong></td>
<td><strong>3.4%</strong></td>
<td><strong>2.7%</strong></td>
</tr>
<tr>
<td><strong>Heat Rejection</strong></td>
<td><strong>2.7%</strong></td>
<td><strong>0.2%</strong></td>
</tr>
<tr>
<td><strong>Pumps &amp; Aux.</strong></td>
<td><strong>2.7%</strong></td>
<td><strong>0.8%</strong></td>
</tr>
<tr>
<td><strong>Fans</strong></td>
<td><strong>1.5%</strong></td>
<td><strong>0.7%</strong></td>
</tr>
<tr>
<td><strong>Heat Rejection</strong></td>
<td><strong>1.5%</strong></td>
<td><strong>0.3%</strong></td>
</tr>
<tr>
<td><strong>Hot Water</strong></td>
<td><strong>1.5%</strong></td>
<td><strong>0.1%</strong></td>
</tr>
<tr>
<td><strong>Cooling</strong></td>
<td><strong>1%</strong></td>
<td><strong>0.3%</strong></td>
</tr>
<tr>
<td><strong>Receptacles</strong></td>
<td><strong>1%</strong></td>
<td><strong>0.1%</strong></td>
</tr>
<tr>
<td><strong>Lights</strong></td>
<td><strong>0.3%</strong></td>
<td><strong>0.1%</strong></td>
</tr>
</tbody>
</table>

---

### DAYLIGHT AND GLARE AUTONOMY STUDIES

#### EXISTING BUILDING

- Daylight Autonomy (25 ft²) DA (50%) = 58% of floor area
- Glare Autonomy (300 ft²) GA = 30% of floor area

#### PROPOSED BUILDING

- **14% IMPROVEMENT IN DAYLIGHT AUTONOMY**
- **GLARE ELIMINATED FROM OFFICE SPACES**
- Daylight Autonomy (25 ft²) DA (50%) = 63% of floor area
- Glare Autonomy (300 ft²) GA = 33% of floor area

---

* Estimated using 2009 ASHRAE Handbook - Fundamentals
** Estimated using THERM/WINDOW 7.4 by LBNL