How can we improve the performance of mid-century office buildings while preserving our architectural heritage?

New York has thousands of commercial buildings built between 1950 and 1980, representing millions of square feet of real estate. According to the Rockefeller Foundation and Deutsche Bank Climate Change Advisors, improving the energy performance of pre-1980s buildings could generate up to $1 trillion in savings over 10 years. Greening existing buildings is our city’s biggest sustainability challenge.

Mid-century commercial buildings perform badly, and in some ways can never meet current standards for energy and comfort. While recladding these buildings might improve their performance, there is an architectural case for preserving mid-century facades as a part of the city fabric. There is also a strong case for avoiding the environmental impacts of demolition.

Our proposal for 200 Park Avenue preserves the most iconic element of the existing facade: its precast concrete shell. On the north and south, we add a new unitized curtainwall outboard of the concrete that uses emerging materials to generate energy while dynamically controlling solar heat gain and glare. On the east and west, we bring the new envelope inboard of the concrete to highlight the materiality and plasticity of the existing skin.

By preserving and overcladding - instead of demolishing and recladding - our proposal reduces the building’s environmental impact by 42% over the next 50 years.

We see our approach as a template for making needed improvements to New York’s existing building stock. Performance-based preservation is a progressive approach to preservation that enables us to meet the challenges ahead without jettisoning the past.
The Pan Am Building has long been criticized for blocking the visual flow of Park Avenue. Since we cannot erase its bulk, our proposal covers the north and south facades with a skin of reflective glass to dematerialize the building’s mass.

At the east and west facades, we take the opposite approach: bringing the line of enclosure inboard of the existing precast concrete to highlight the building’s materiality and depth.

Compared to the existing building, our proposal reduces energy use by 54%, reduces carbon by 56%, and reduces the overall burden on our environment by 42% over the next 50 years.

Concrete has a high embodied energy and is one of the least recyclable building materials. Rather than demolish the existing precast facade, we are preserving it and adding a high-performance overcladding.

The new curtainwall integrates transparent photovoltaics and a switchable LCD interlayer into the glazing, generating energy and reducing direct solar gain.

The dynamic glazing regulates occupant comfort by reducing glare without penalties for daylight penetration. Compared to the existing building, our proposal reduces glare by 91%.
Design Proposal

WT-01: Tower North and South Facade
Aluminum and glass curtainwall system with decorative stainless steel cladding and shadowboxes anchored outboard of existing precast concrete facade. Glazing on the south facade includes transparent photovoltaic and switchable liquid crystal interlayers.

WT-02: Tower East and West Facade
Aluminum and glass window wall system installed inboard of existing precast concrete facade. Includes decorative stainless steel cladding at head, sill and jambs and column covers.
WT-01: Tower North and South Facade

CONC-01
Existing precast concrete

GL-01
Insulating glass with tPV, LC, and low-e coating

MT-01
Stainless steel infill and shadowbox

Firestop and smoke seal

Anchor bracket welded to existing steel C-channel

U-Value
Vision 1.30 W/m2K
Spandrel 0.93 W/m2K
WT-02: Tower East and West Facade

GL-02
Insulating glass with low-e coating

MT-01
Stainless steel cladding

CONC-01
Existing precast concrete

U-Value
Vision 1.30 W/m2K
Spandrel 0.20 W/m2K
Materials

**GL-01: South Facade**
IGU with laminated outer lite; tPV interlayer, LC interlayers with five switching states, and low-e coating
Outer lite: 3/8” Low-iron, Heat Strengthened
  - Transparent Photovoltaic (tPV) interlayer
  - .030” PVB interlayer
  - Liquid Crystal (LC) interlayer
  - .030” PVB interlayer
  - 3/8” Low-iron, Heat Strengthened
  - Low-e coating on #4 surface with 30% exterior reflectance
Cavity: 1/2” airspace w/ Argon fill and warm-edge spacer
Inner Lite: 3/8” Low-iron, Fully Tempered

**GL-02: North, East, and West Facade**
IGU with low-e coating
Outer lite: 3/8” Low-iron, Heat Strengthened;
  - Low-e coating on #2 surface with 30% exterior reflectance
Cavity: 1/2” airspace w/ Argon fill and warm-edge spacer
Inner Lite: 3/8” Low-iron, Fully Tempered

**MT-01: Stainless Steel Cladding**
Finish: “Linen” textured finish

**CONC-01: Existing exposed-aggregate precast concrete**

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**Glass Technology**

The IGU on the south facade combines energy generation with dynamic control of solar heat gain and glare.

- The outer lite includes a transparent photovoltaic interlayer (tPV) that generates energy over the entire surface of the glass without obstructing views.\(^1\)
- Behind the PV, a liquid crystal interlayer (LC) allows switchable control of the visible light transmittance for occupant comfort and solar control.\(^2\)
- A low-e coating on the #4 surface provides low backside hemispherical emissivity and the architecturally desired reflectivity.

**Notes:**
1. tPV such as emerging products from Ubiquitous Energy
2. LC switchable glazing, such as emerging products from EMD/Merck
3. Mention of products does not constitute endorsement

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\(^1\) Energy transfer and conversion at IGU

\(^2\) Combined Transmittance
WT-01 Installation

Existing: Full-height “fixed” precast concrete panels alternating with “loose” precast spandrel panels

Step 1: Remove loose spandrel panels; install anchor assembly to existing steel spandrel beam

Step 2: Install curtainwall units from exterior

Step 3: Install firestopping, smoke seal and trim from interior
**Emery**

**Emery of Materials and Energy**

Emery (spelled with an ‘m’) is a concept by H.T. Odum that allows for evaluation of the stress placed on our environment due to a particular process(es). It is a comprehensive method to evaluate the sustainability of a building proposal. Here, we use emery to evaluate the environmental cost of keeping existing facade, recladding, and overcladding.

By 2066, compared to the existing building, the overcladding reduces the cost to the environment by 42%. In contrast, the re-cladding option increases the cost to the environment by 1%.

**Keep Existing vs. Re-cladding vs. Overcladding**

- **Keep Existing**
  - no change to existing facade
  - environmental cost for the next 50 years = remains constant

- **Re-cladding**
  - demolition
  - recladding
  - environmental cost for the next 50 years = increases by 1%
  - recycle
  - preserve structure
  - add high-performance overcladding
  - environmental cost for the next 50 years = decreases by 42%

**Emery Analysis [sej/yr/m2]**

- Demolition
- Recladding
- Environmental cost for the next 50 years = increases by 1%
- Recycle
- Preserve structure
- Add high-performance overcladding
- Environmental cost for the next 50 years = decreases by 42%

**Operating Energy, Energy Generation and Carbon Emissions**

In terms of energy performance, compared to the existing building, our proposed facade reduces energy use by 54%, reduces carbon by 56%, and generates energy through the use of photovoltaics.

**Methodology**

Whole building energy models were performed using Energy Plus 8.4 with conceptual level perimeter and core thermal zoning at two representative floors of the plinth and three representative floors of the tower. All energy models used ideal air loads and included site shading. Envelope and glazing characteristics were determined in Therm 7.2 and Window 7.2. For proposed models with dynamic glazing, a Radiance 3-phase method was used to more accurately determine interior illuminance distribution and dynamically switch glazing properties during Energy Plus runtime. Photovoltaic array electricity generation additionally used Energy Plus and assumed a 10% solar t-to-electric efficiency and does not account for derated efficiency from cell temperature or inverter properties.
Visual Comfort

Glare Control
The new glazing dynamically regulates occupant comfort by reducing glare without penalties for daylight penetration.

As compared to the existing design, our proposal reduces glare by 90%, completely eliminating any risk of visual discomfort during the summer months without incurring in additional artificial illumination. The annual glare analysis has been based on the Daylight Glare Probability index, which takes into account the proximity to the facade, orientation and indirect reflections on fully-furnished space.
Dynamic Glass

The dynamic glazing not only improves the interior environment — it also registers as a design element on the exterior.

The glass changes color as shadows move across the facade over the course of the day.