

CIBSE ASHRAE Group 15 February 2012

50 year old air conditioning systems in USA

(How they are kept operating and energy efficient)

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Chicago Architecture and Art Showcase



Chicago Architecture and Art Showcase



Chicago Architecture and Art Showcase



Trump International Hotel and Tower



Fisher Building



50 year old air conditioning systems in USA



Inland Steel



Richard J Daley



John Hancock

Building Comparison

Building	Inland Steel	Richard J Daley	John Hancock
Completed	1958	1965	1970
Floors / Height	19 / 101m (332ft)	31 / 203m (667'-5")	100 / 334m (1,127ft)
Gross Floor Area	28,780m ²	136,220m ²	232,542m ²
Thermal	Tinted Single/Double? Full height glass	Tinted Single	Single Ground to 41 Double 43 to 97
Air conditioning	Dual Duct High Velocity Floor outlet	Perimeter Induction (Changeover) CAV Reheat Interior	Perimeter Induction (Changeover) CAV Reheat Interior
Fuel	Gas	Heavy Oil / Gas	Electric
Boiler Power	10.3 MW	29MW	19.3MW
Frig Power	3.3MW	29MW	24MW

The Inland Steel Building - 1958

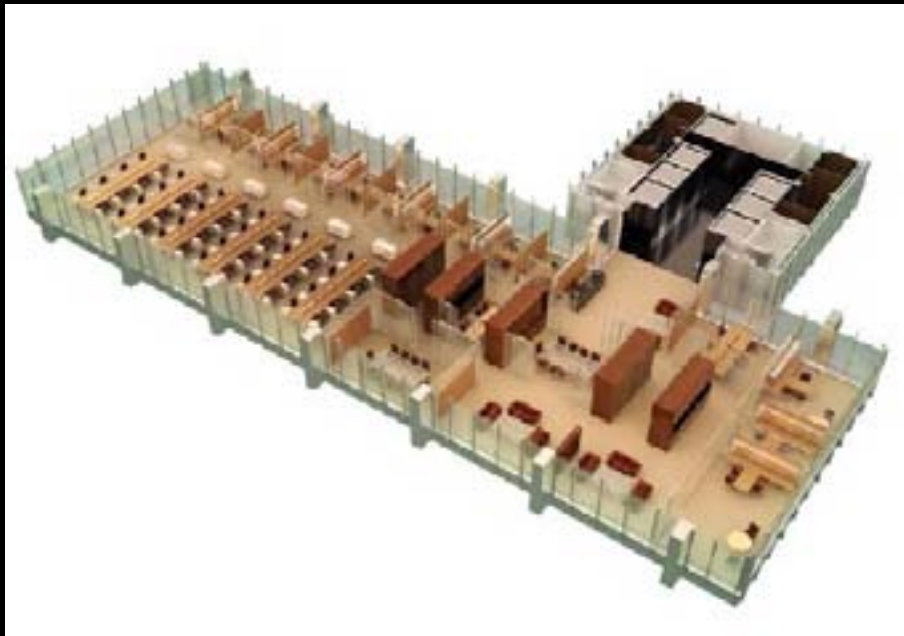


FLOOR 14 - 12,580 RSF

AVAILABLE SUITE	SIZE
1400	12,580



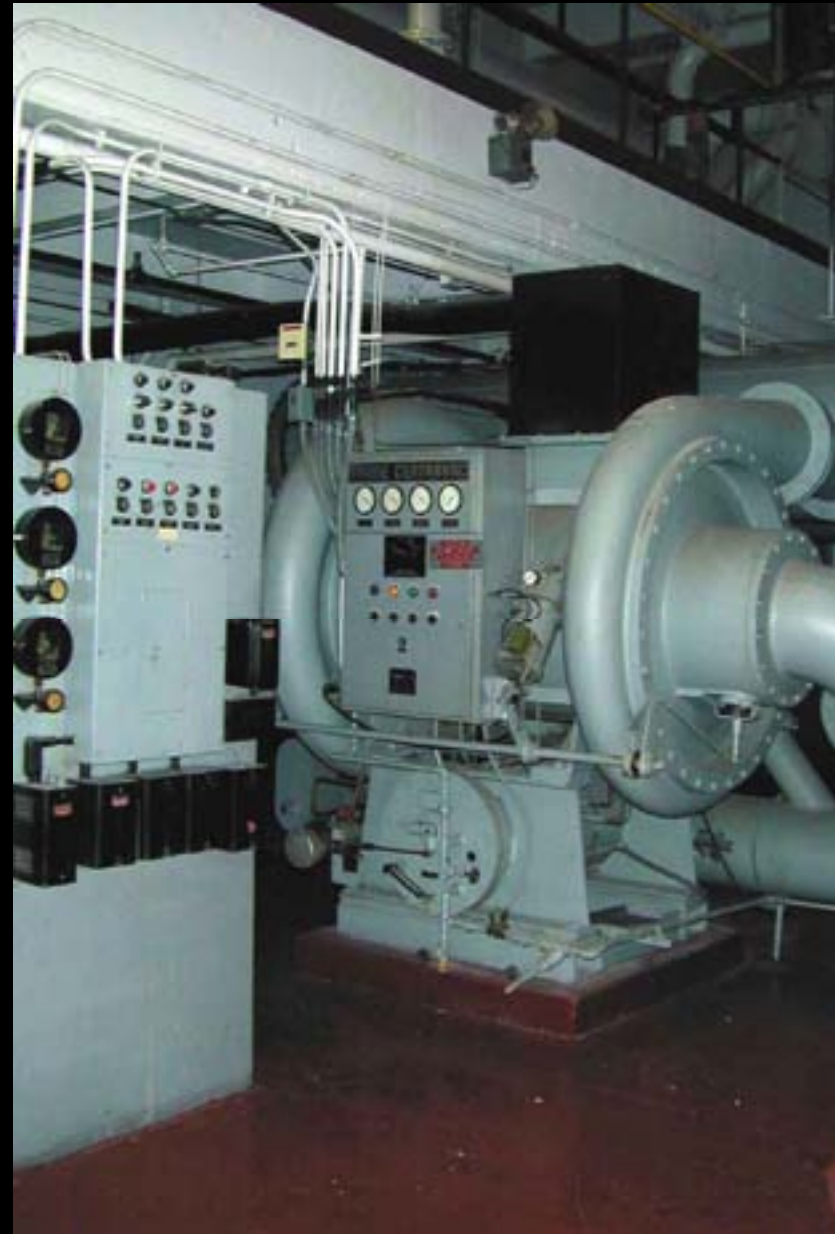
The Inland Steel Building - 1958



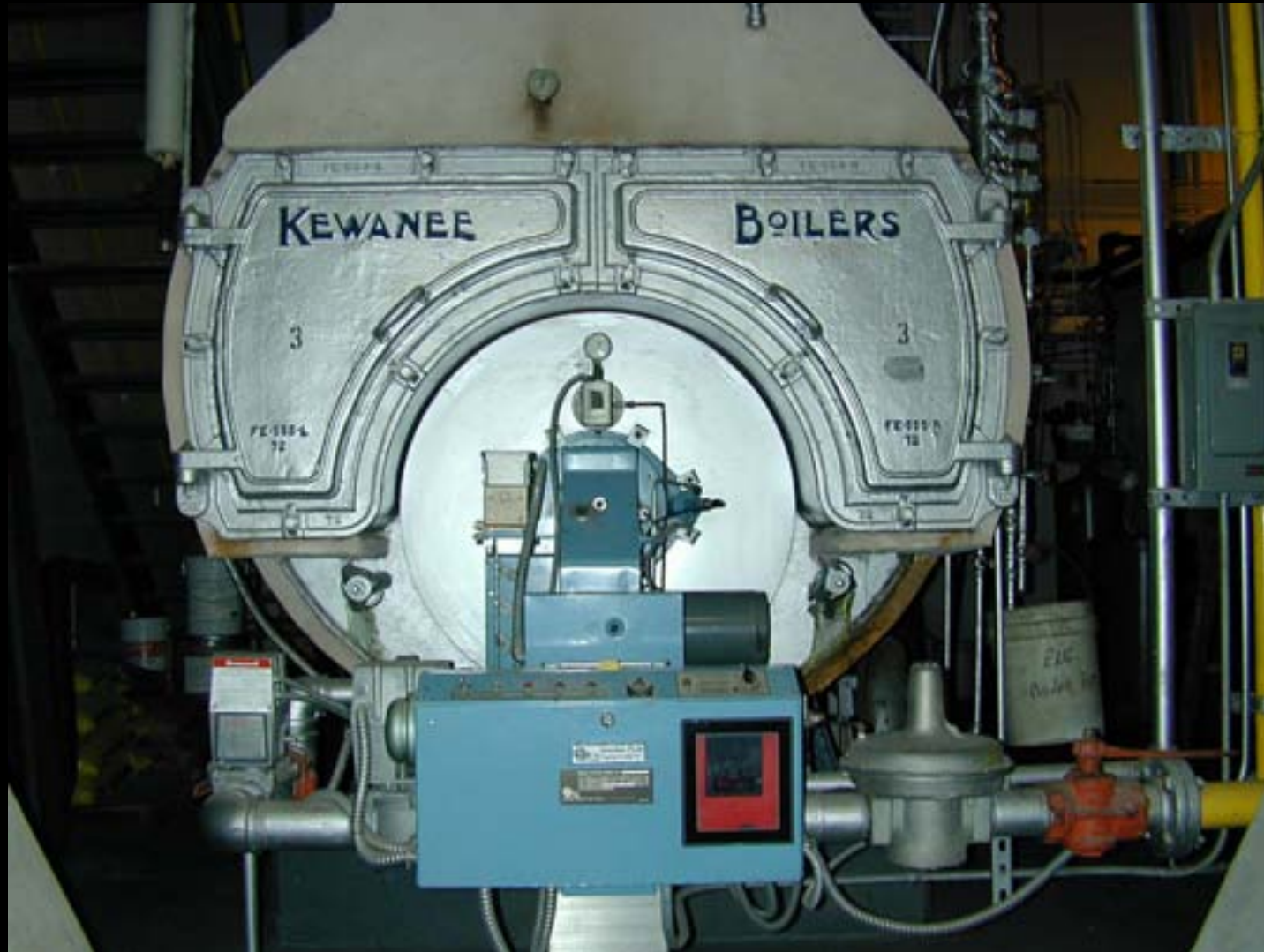


Interior Photo c1960

The Inland Steel Building - 1958



Steam Boiler (1957)



Fans and Pneumatic Controls (1957)







WARM AND COOL AIR will travel through subfloor ducts up into channel floor spaces, $3\frac{3}{8} \times 3\frac{3}{4}$ in., out to the perimeter of the building where the air is introduced into the occupied space above at the floor level. Shown here is sheet metal worker cutting openings in the bottoms of floor channels



The Richard J Daley Center
1966







John Hancock Center 1970







Energy Saving Measures

Energy Measure	Inland Steel	Richard J Daley	John Hancock
Digital Controls	✓	✓	✓
Inverter Drives	✓	✓	✓
CAV to VAV	✓	✓	✓
Thermal Performance	Retrofit	Glazing / Windows	
Air conditioning	High Velocity VAV	P. Induction Day Convectors Night VAV Interior Energy Star Rating	
Fuel		Gas	
Boiler		Operate Single Boiler	
Frig	District Cooling New Leased Chillers	29MW	Retained R114

Energy Saving Measures – Hancock

- Digital Controls
- Inverter Drives
- CAV reheat to VAV no reheat
- **Replace / Retrofit R114 Chillers with HFC**



Inland Steel Building Transformation Project (2008)

- To transform the 52-year-old Inland Steel Building into a LEED Platinum project,
- SOM's master plan had a comprehensive list of environmental strategies. The plans included:
 - Double Glazed External Walls
 - Heat Recovery
 - Chilled Beams
 - Fuel Cell on site generator



- <http://www.metropolismag.com/story/20100616/blue-sky-thinking>

Inland Steel Building Transformation Project (2008 Conference Paper)

- The Inland Steel Building is being rehabilitated and repositioned as an office building to compete in the 2008 marketplace.
- Project seeks 20% federal historic rehabilitation tax credits, thereby requiring compliance with Secretary of the Interior's *Standards for Rehabilitation*.
- As a Chicago Landmark, changes to exterior and lobby are subject to review and approval by the Commission on Chicago Landmarks.
- A challenge of rehabilitating the Inland Steel Building for the current market is to preserve significant modern interior features while accommodating the needs of a variety of tenants.

Inland Steel Building Transformation Project (2008)

- SOM matched the building's original innovations in today's terms—sustainability, flexibility, ease of use—and demonstrated the outer limits for LEED in a 52-year-old shell.
- Inland Steel has become a case study in what you can do to green a mid-century building, as well as what you can't, economically and legally.
- National Landmark (1998)
- After the economy soured in 2008, Capital began to scale back its goals for Inland Steel.....

Inland Steel Building Energy Saving Measures (2012)

- Replacement of Pneumatic Controls
- Dual duct system conversion to VAV
- Retrofitting vacant floors
- Dual duct boxes replaced progressively
- Disconnection from District Cooling
- New 425 TonR Chiller (Leased)

The Richard J Daley Center – Energy Saving Measures

- Digital Controls
- Inverter Drives
- CAV reheat to VAV no reheat
- Minimise Plant Use
 - Cooling Towers
 - Boilers
 - Chillers
- Energy Star / LEED Measures
- Fuel Bill Halved (Electricity 266 W/m² in 1997 to 151 W/m² in 2011)

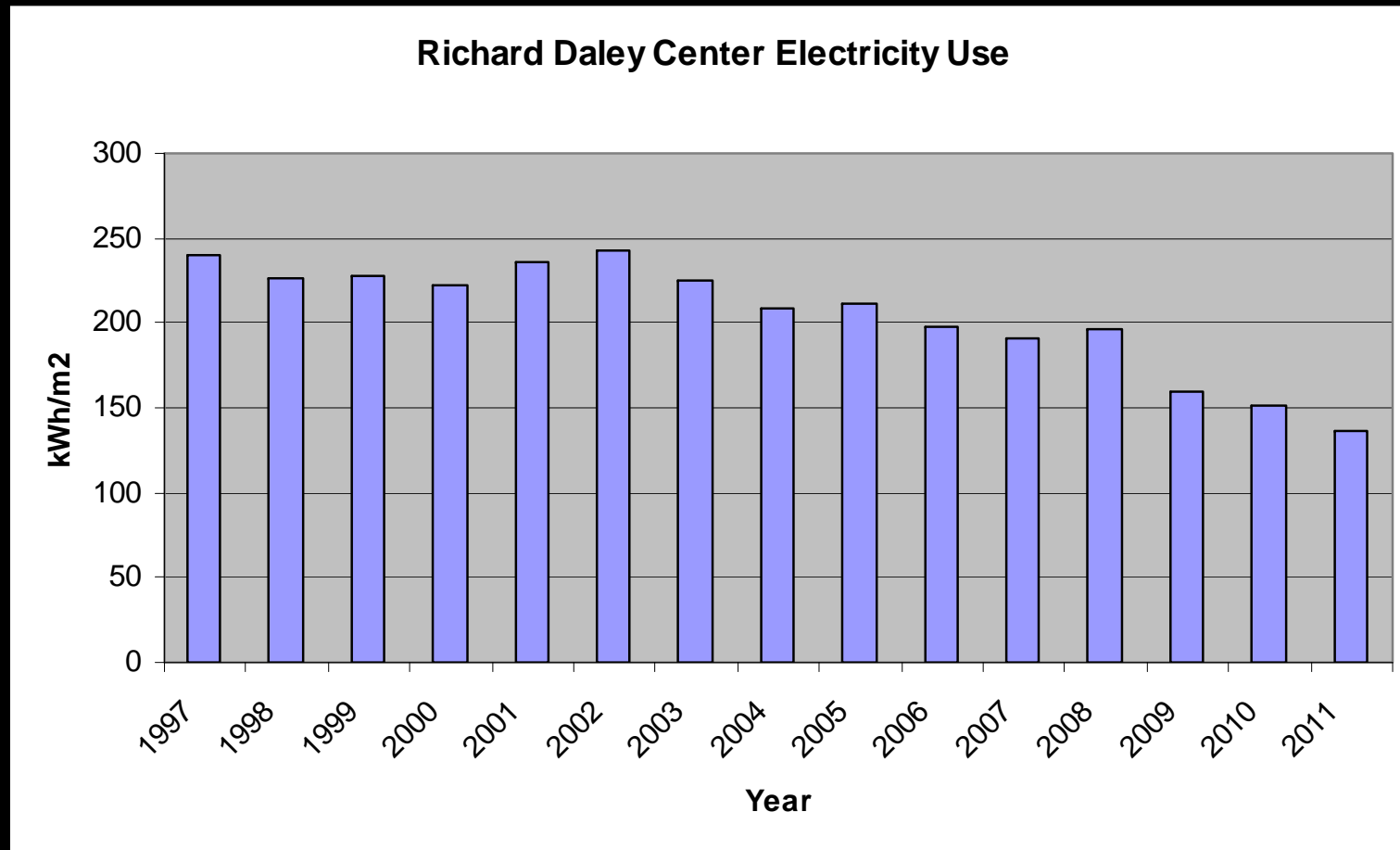
Energy Star Measures

- Induction System Modification
- Boiler/Cooling System Modification
- Lighting Modification
- Water Conservation Measures
- Next Generation Improvements

http://www.energystar.gov/index.cfm?fuseaction=labeled_buildings.locator

http://www.energystar.gov/index.cfm?fuseaction=labeled_buildings.showProfile&SEARCH_OWNER_ID=&S_CODE=IL&PROFILES=0&YEAR=&BUILDING_TYPE_ID=720&SEARCH_SPP_ID=&CITY=chicago&STARTNUM=1&ZIP=&SEARCH_PROP_MANAGER_ID=&FILTER_B_ID=&profile_id=1009467

Energy Saving Results



Chicago - Green Roofs and Heat Islands



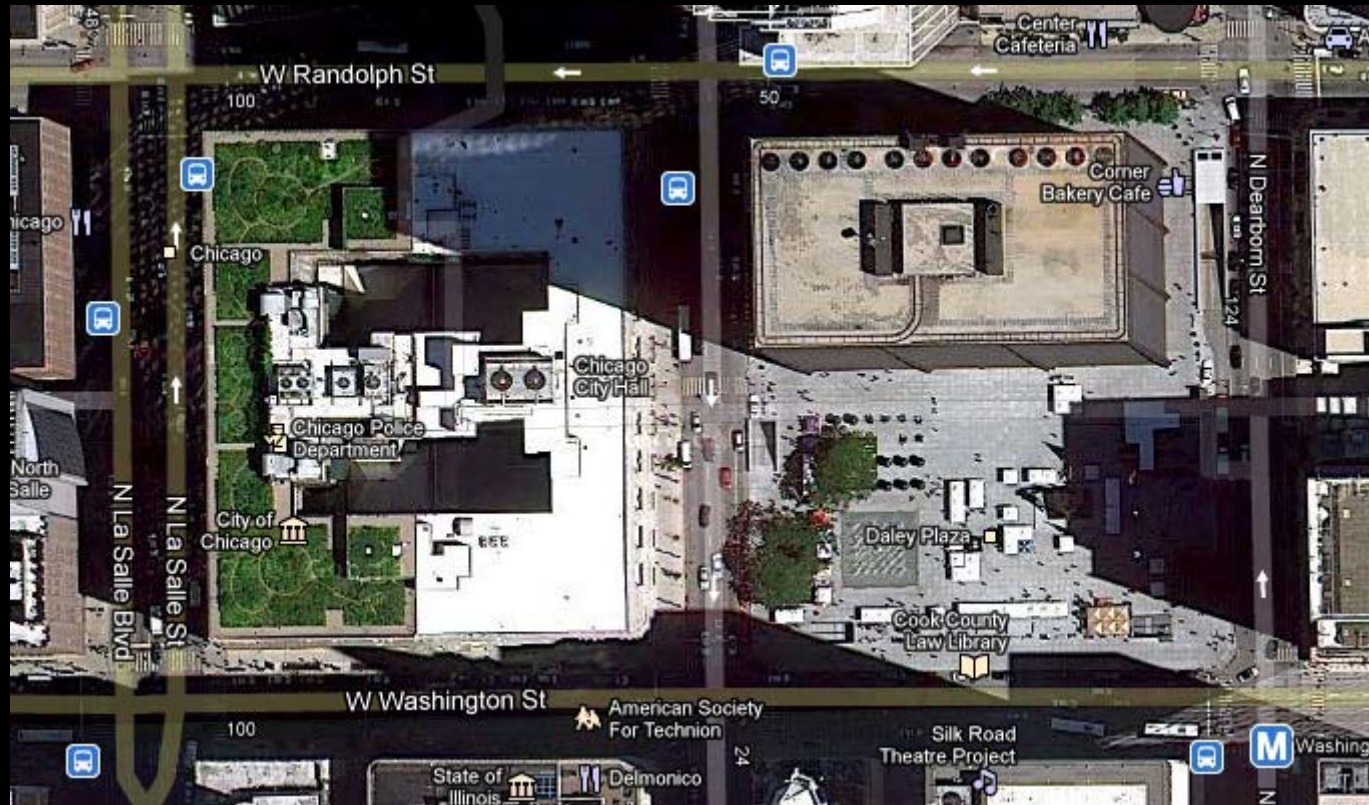
Chicago - Green Roofs and Heat Islands



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Chicago - Green Roofs and Heat Islands



New v. Old

- The Chicago Center for Green Technology (2003)
 - LEED Platinum
 - Mixed Mode
 - Ground source heat pumps
 - <http://www.cbe.berkeley.edu/mixedmode/ccgt.html>
- Art Institute Chicago – Extension (2009)
 - Architect – Renzo Piano
 - Building Services – Arup London
- LEED Silver

Art Institute Chicago – Modern Wing (2009)



Art Institute Chicago – Modern Wing (2009)

LEED Silver

- Variable air volume system fan energy saving 40%
- Carbon dioxide sensors 12% energy saving
- An air-side economizer 4% saving.
- A water-side economizer to provide “free cooling”
1% saving
- High thermal performance glazing
- A double-layer exterior envelope of transparent,
glazed walls
- A daylight-linked interior lighting system

Summary

How does the USA manage energy use in its stock of old air conditioned buildings?

- 18% of Energy is used in commercial buildings;
 - IEA rate of replacement of old buildings is 1%;
 - Old buildings will represent 60% to 75% of the building stock in 2050;
- Innovation to save energy in existing buildings essential;
- Techniques in these buildings show how it can be done;
- LEED/BREEAM/Energy Star demonstrate success
- Further innovation necessary to meet Carbon Emission Reduction Target

Thank You

- Brendan and Alison Capital Properties (Inland Steel)
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- Mikal Ahmed Arup – Chicago Art Institute Extension

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