





## Session 1

- Introduction to ARCH 447
  - Course outline
  - Course projects and groups
  - IALD conference
  - Course readings
- History of Electric Lighting
- Brief overview of Ecotect and Radiance

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    - <http://www.iald.org/pdfs/IALDEnlighen2007APwREG.pdf>
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## Brief History of Artificial Light and Power

## Met Life Building, New York



1930



2003

## Empire States Building, with Towers of Light



**Tower of Winds, Toyo Ito, Tokyo**



**Rodin Museum, Seoul**





## Individual control and portability

- exterior to interior
- bi-products: smoke, heat, soot



**George LaTour, 1635**

- night by candlelight



**Johannes Vermeer, 1669**

- critical importance of daylighting





### **Argand Lamp, 1783**

- improved wick
- Glass chimney
- Dimming

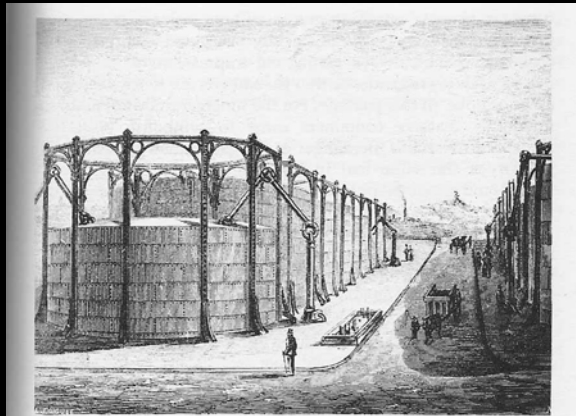


### **Gaslight, 1800**

- First factory lighting
- Distribution network required
- Less by-products, brighter

## **Industrialization**

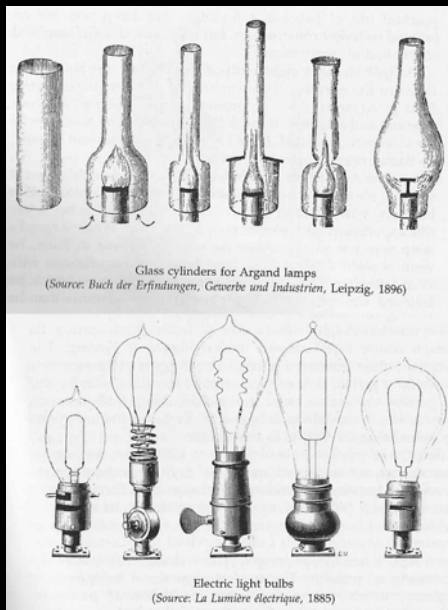
- Push from manufacturers in England to lengthen work day
- Gas is distilled by heating coal. England, with vast reserves of coal, takes the lead in gas lighting
- First power generators and centralized fuel sources are built by privately owned companies to serve their factories
- Windsor receives first consumer gas in 1814
- Montreal is lit with 300 gas street lamps by 1835



Gasometer, about 1870  
(Archiv für Kunst und Geschichte, Berlin)

## Gasometer, 1870

- Centralized production of gas
- Distilled from coal

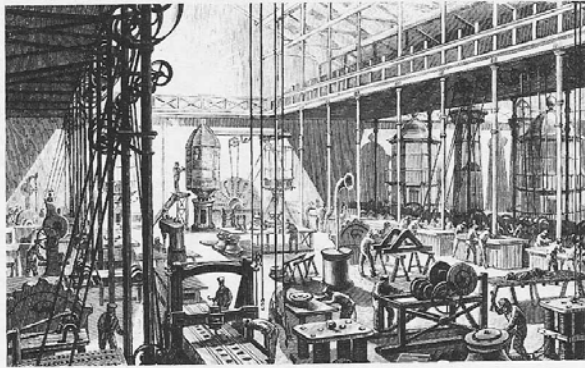


Glass cylinders for Argand lamps  
(Source: Buch der Erfindungen, Gewerbe und Industrien, Leipzig, 1896)

Electric light bulbs  
(Source: La Lumière électrique, 1885)

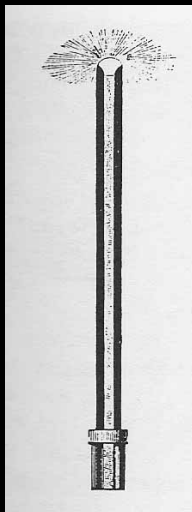
## Technology transferred

- Gas to Incandescent
- Chimney = envelope
- Wick/flame = filament
- Dimmer = switch



Factory lit up by electric arc lighting  
 (Source: H. Fontaine, *Eclairage à l'électricité*, Paris, 1877)

## Factory Lighting by Arc Light, 1877

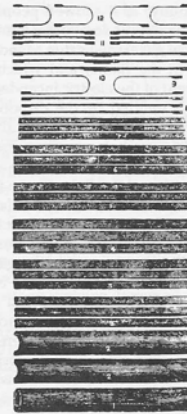


### Arc Light

- High intensity
- Poor control
- Poor colour rendering

## Thomas Edison, 1882

- Edison experiments with the carbonization and splitting of bamboo fibers
- Balance between strength and resistance
- Bamboo is eventually replaced by tungsten filament



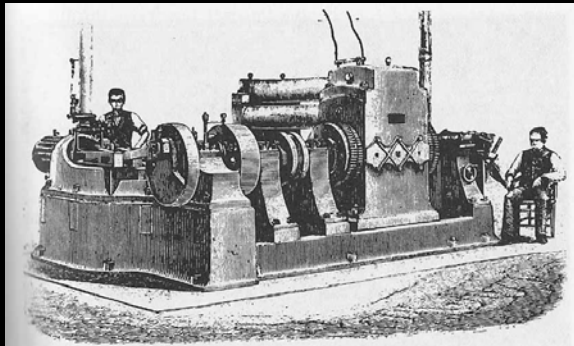
From bamboo to filament.

The illustration shows the gradual transformation of nature into technology. The particular bamboo that, after many years of searching, Edison had selected as the most suitable for his purpose was split repeatedly to separate it into fine fibres, which were carbonised and then bent into the shape of a filament.

(Source: *L'Electricité*, 1882)

## Thomas Edison Dynamo, 1881

- Powered by coal, or by water in factory locations, dynamo provided centralized electrical power
- First electrical networks were in New York and catered to wealthy individuals such as the Rockefellers
- Consolidated Edison (now "Con Ed") is the first network of generators



Edison's dynamo (1881).

(Source: A. Fürst, *Das elektrische Licht*, 1926)

## Light and Social Change



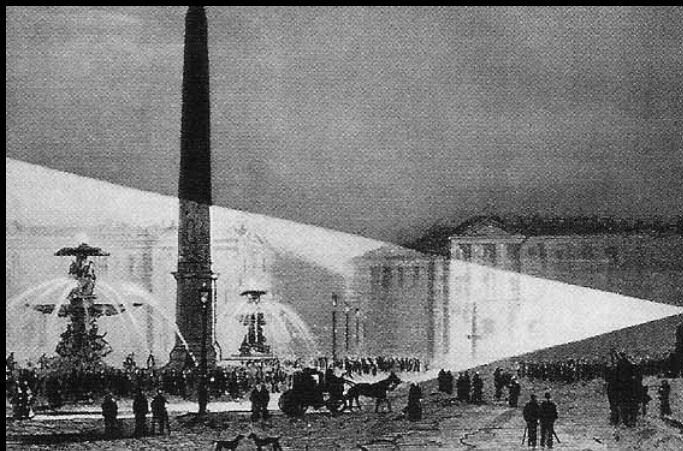
### Lighting and the French Revolution, 1789

- Monarchy attempts to reduce crime and aid night patrol of cities with gas street lighting
- Smashing lanterns was a severe crime punishable by imprisonment
- Following the revolution, monarchy, and clergy (as in illustration) were hung from lanterns



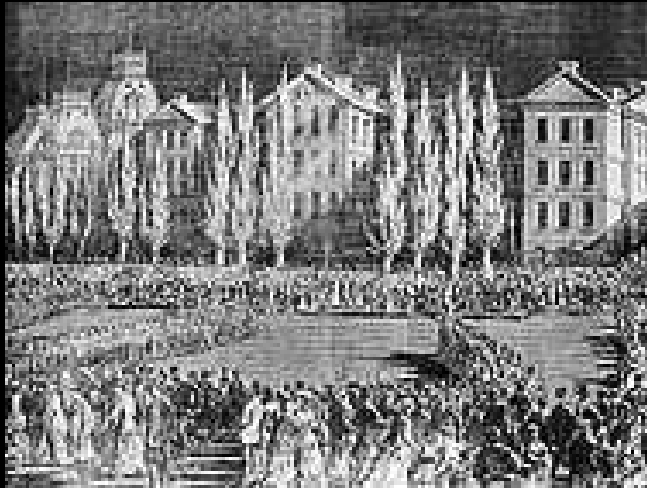
### **Public Display of Fireworks, 1774**

- Illumination as power of the state
- First examples of later public illumination projects



### **Arc lighting Place Vendome, 1884**

- Illumination as power of the state
- First examples of later public illumination projects



## **Arc lighting Champs de Mars, 1879**

(Montreal)



## **Expositions and World Fairs**

- Showcase for technology and national pride
- Temporary installation with maximum impact

### **Paris Exposition, 1867**

- Gas lighting fails to draw crowds

### **Chicago World's Fair, 1894**

- Electric lighting, fair open after dark
- Buildings "carry" lights, they are accented



### **San Francisco, 1915**

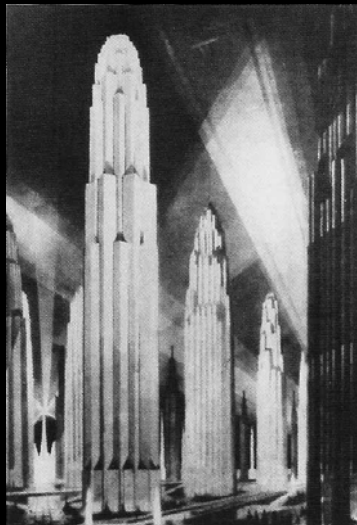
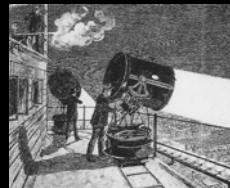
- Buildings are floodlit





## Eiffel Tower, World's Fair 1889

- Replaces initial design for a "Sun Tower", an artificial sun for all of Paris
- Uses arc light search light and St. Elmo's fire



## Hugh Ferriss, 1922

- Heroic machine age



## Fritz Lang, Metropolis, 1927

- foreboding authoritarianism





**Fascist displays of state  
power, 1936-1939**

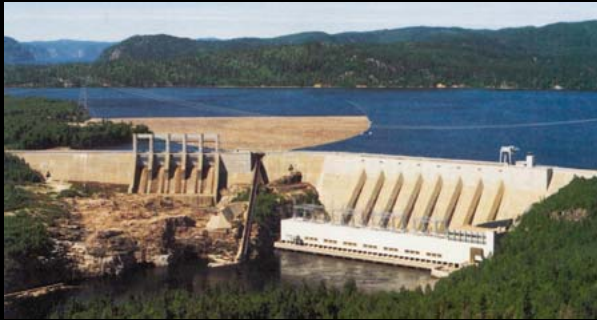


## Electric Power in Quebec



## Beauharnois, dam and substation, 1929

- First major installation by unified Hydro Quebec



## Hydro Quebec

- "World Leader in hydro electricity"

- 96% hydro power, 4% thermal, nuclear and gas generated. Wind power currently under development



Manic 1

Manic 5



St. Marguerite 3

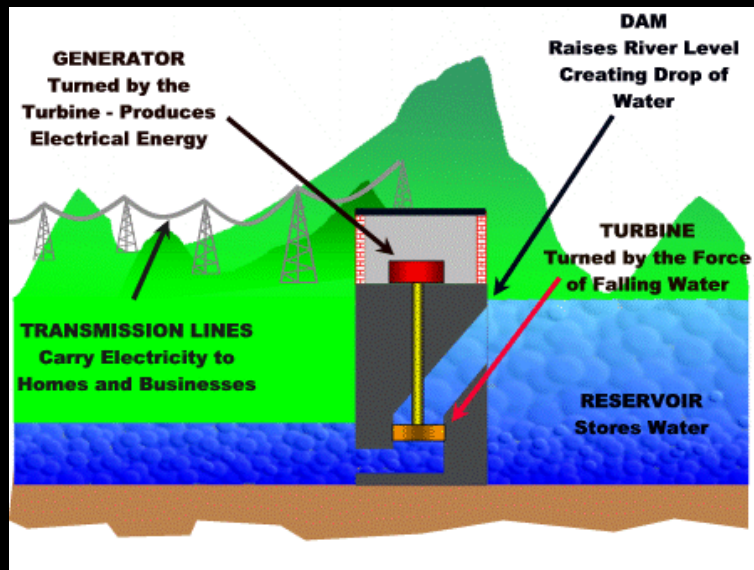


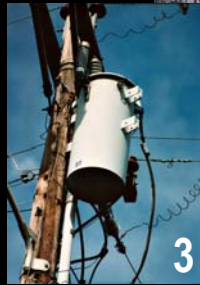
## Hydro Quebec Distribution Network

-“For the Québec market, the division supplies a heritage pool of up to 165 TWh per year, which it is obliged to sell at a fixed price of 2.79 cents per kilowatthour.”

-Network is part of a grid which includes North Eastern United States

-Hydro-Québec Distribution estimates that by that year it will require 1,200 megawatts to meet the energy needs of its Québec customers. The division also stated its intention to issue a call for tenders for a total of 1,000 megawatts of power generated by wind farms over the next ten years.







## Session 1

### -Software notes

#### -Radiance

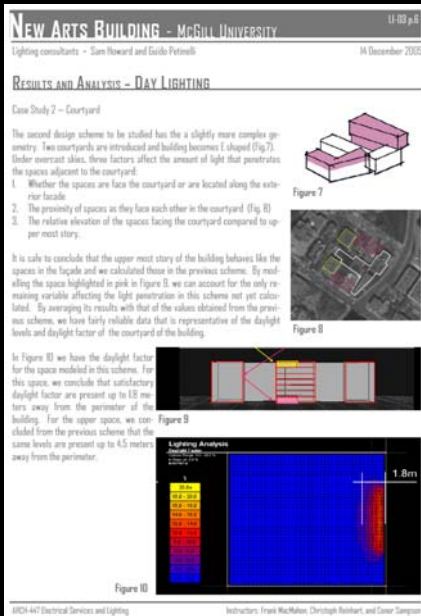
-If you intend to use Radiance on your own machine, follow instructions for download and installation in "Getting Started Tutorial" on course website

#### -Ecotect licensing agreement:

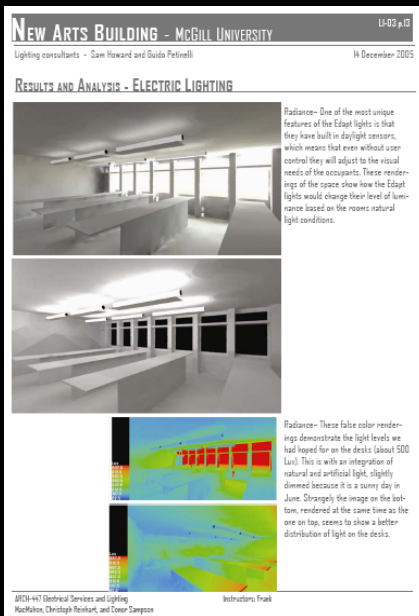
-<http://squ1.com/ecotect>

-Please confirm functionality of school installed version in 1<sup>st</sup> floor lab





Petinelli-Howard, 2005

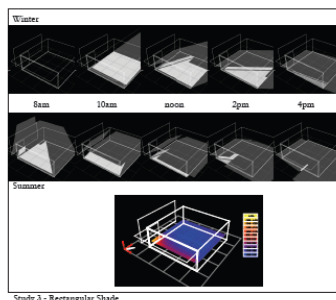
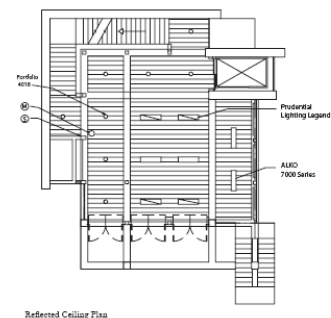


6.0

## Design Recommendations

The final design provides, not only adequate lighting for the tasks required, but includes lighting features that are designed to improve the learning environment. The light fixtures and lamps selected were chosen for their consistency with the design intentions, suitability within the classroom setting, environmentally conscientiousness, and economic benefits.

Please review the following design recommendations based on the preceding research and studies. Specifications for all recommended lamps and fixtures are included in the appendix.



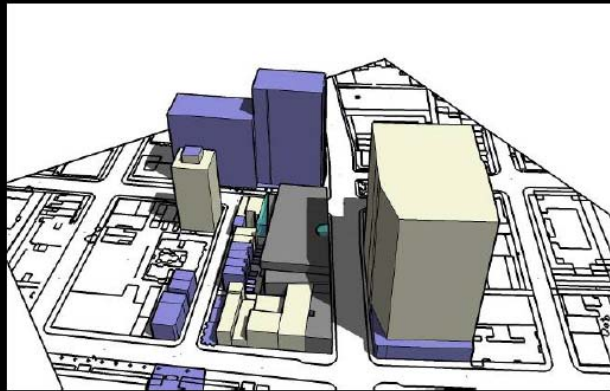
The two studies with the shading devices yielded similar results. This confirmed our assumption that we would be able to make a comparable shade using more standard architectural shapes that were more aesthetically appropriate to the solution. The rectangular shape provided negligible differences as compared to the automatically generated shape and so, considering it was to structurally act as the balcony of the classroom above, it was decided to be the most effective approach. After studying that with the basic model, another final study was completed with a more detailed model.

Jerome-Bondi, 2005



## CAFÉ + LOUNGE

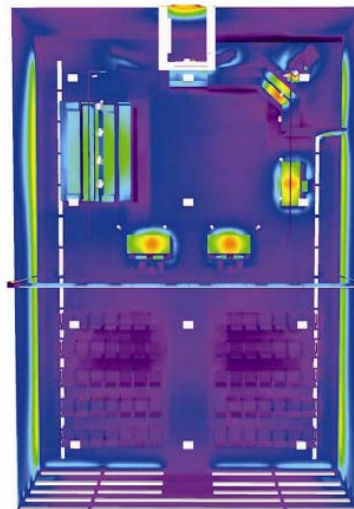
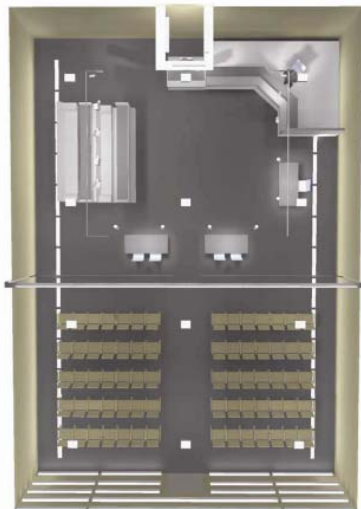
PROJECT OVERVIEW  
SPATIAL CONSIDERATIONS  
LIGHTING OBJECTIVES  
RESULTS + ANALYSIS  
DESIGN STRATEGY  
PROJECT SUMMARY



SHADOW STUDY 09:00 – 16:00

**Cagara-Paden-Theriault-Socolova, 2006**

## NUMERICAL ANALYSIS



Courtroom lighting Design

Carrington-Delage-Gonneville-Ngo\_Group 03

**Carrington-Delage-Gonneville-Ngo, 2006**