

Wind and the City



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GREEN Program 201
Capstone Project

Where: Chicago, Illinois

- Known as the Windy city
- High wind speeds
- Large population
- Close to demand
- Ranks #1 in buildings certified under LEED (Leadership in Energy and Environmental Design)
- Mayor Emanuel's is committed in his vision to “make Chicago the most attractive and sustainable city of the 21st century”

Wrigley Building

- Built in 1920s
- “Jewel” of Chicago architecture
- Made of 250,000 terra cotta tiles
- 2 buildings joined by 14th floor skywalk
- 30 stories or 450ft/ 137m

Location



Retrofit Chicago

- 14 buildings with 14 million square feet
- Buildings pledge to reduce energy use by 20% within the next 5 years
- Start work within 6 months
- Carbon impact equivalent to taking over 8,000 cars off the road
- Save more than \$5 million a year in energy costs
- Create economic opportunity and more than 100 jobs

"By joining the Better Buildings Challenge, Chicago is not only leading by example, but is also better positioning the city in the global economy by saving millions in energy costs."

Location

Policies

The Helix Turbine

- Cost effective
- More reliable
- Less maintenance
- Better in turbulent settings
- Lower noise level
- Less vibration



Location

Policies

Technology
Overview

Technology Overview

- The low speed Helix Wind turbine will start generating power at a little over 8mph
- Self-starting
- No over speed control necessary.
- Survivable in sustained wind of 80mph

Location

Policies

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Cost

$$\begin{aligned} \text{Number of Towers} * \text{Cost of Tower} &= \text{Capital Cost} \\ 10 * \$17,500 &= \$175,000 \end{aligned}$$

Installation cost
\$ 100,000

Maintenance cost
\$ 25,000

$$\begin{aligned} \text{Capital Cost} + \text{Installation Cost} &= \text{Up front cost} \\ \$ 175,000 + \$ 100,000 + \$ 25,000 &= \$ 300,000 \end{aligned}$$

Location

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Financial
Analysis

Savings

$$24 \frac{h}{\text{Day}} * 365 \frac{\text{Day}}{\text{Year}} * 4.5 \frac{kW}{\text{Turbine}} = 39420 \frac{kWh}{\text{Turbine}}$$
$$= \frac{\text{Optimal Power}}{\text{Year} * \text{Turbine}}$$

$$10 \text{ turbines} * 39420 \frac{kWh}{\text{turbine} * \text{year}} * 0.30 = 118,260 \frac{kWh}{\text{year}}$$
$$= \frac{\text{Estimated Power}}{\text{year}}$$

$$20 \text{ years} * 118,260 \frac{kWh}{\text{year}} * 0.15 \frac{\text{dollars}}{kWh} = \$ 354,780$$
$$= \text{Lifetime Value}$$

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Net Profit

Value – Total Cost – Subsidies = Lifetime Profit

$\$ 354,780 - \$ 300,000 - \$60,000 = \$ 54,780$



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Assumptions

Installation cost = \$ 100,000

Maintenance cost = \$ 25,000

The turbines will get 30 % of the optimal capacity

Cost of the electricity = \$ 0.15 per kWh

This is based on the average cost of electricity in Chicago, \$ 0.153 per kWh, from US department of labor statistics.

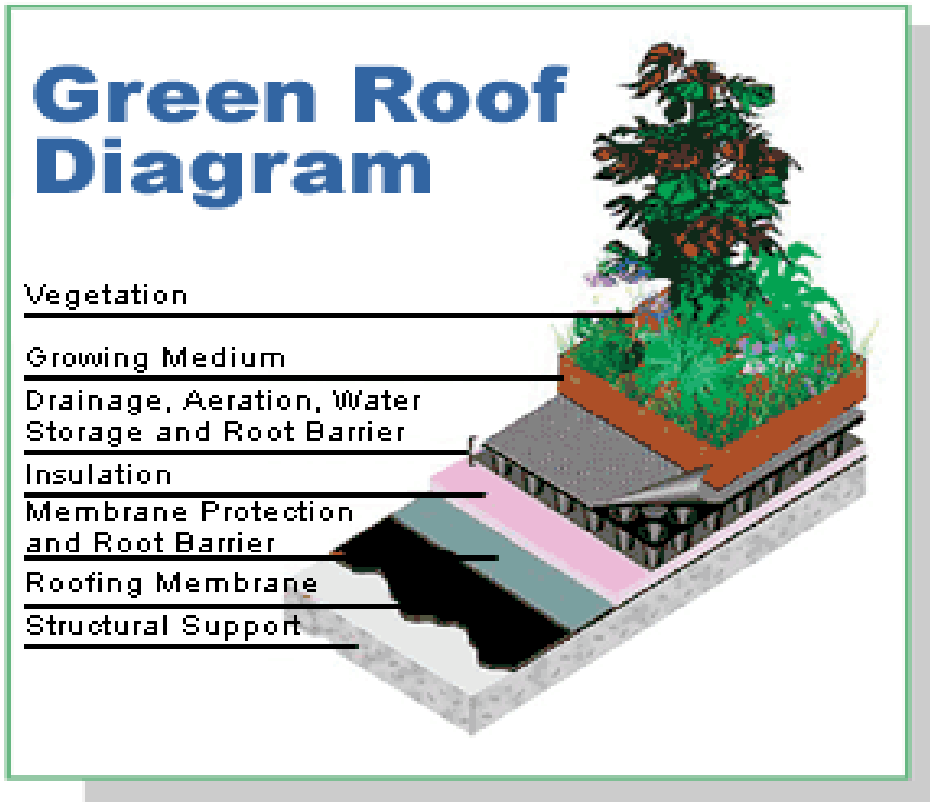
Location

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Green Roof



- Retains and filters rainwater
- Cools city air by absorbing less heat
- Cut energy costs
- Extends roof lifespan
- \$20 per sq. ft

Location

Policies

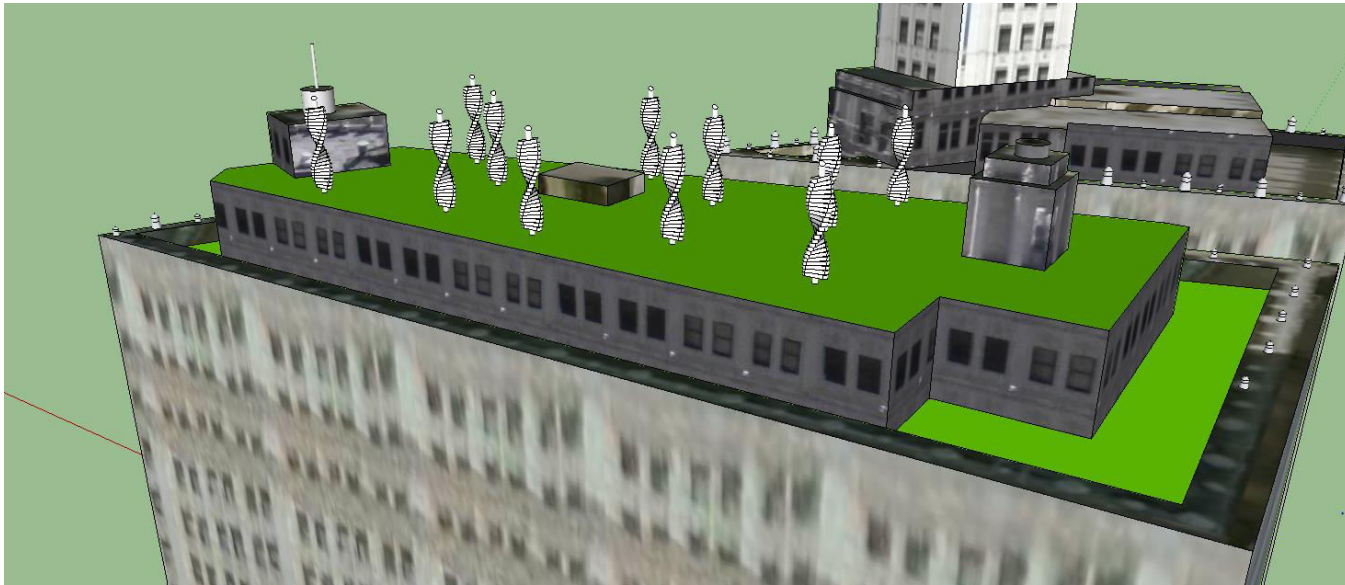
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Green
Roofs

Green Roof

- Chicago City Hall Building retains more than 75% of water produced by a one-inch storm
- An overall 50% reduction in total storm water runoff from this green roof
- Benefits the sewers



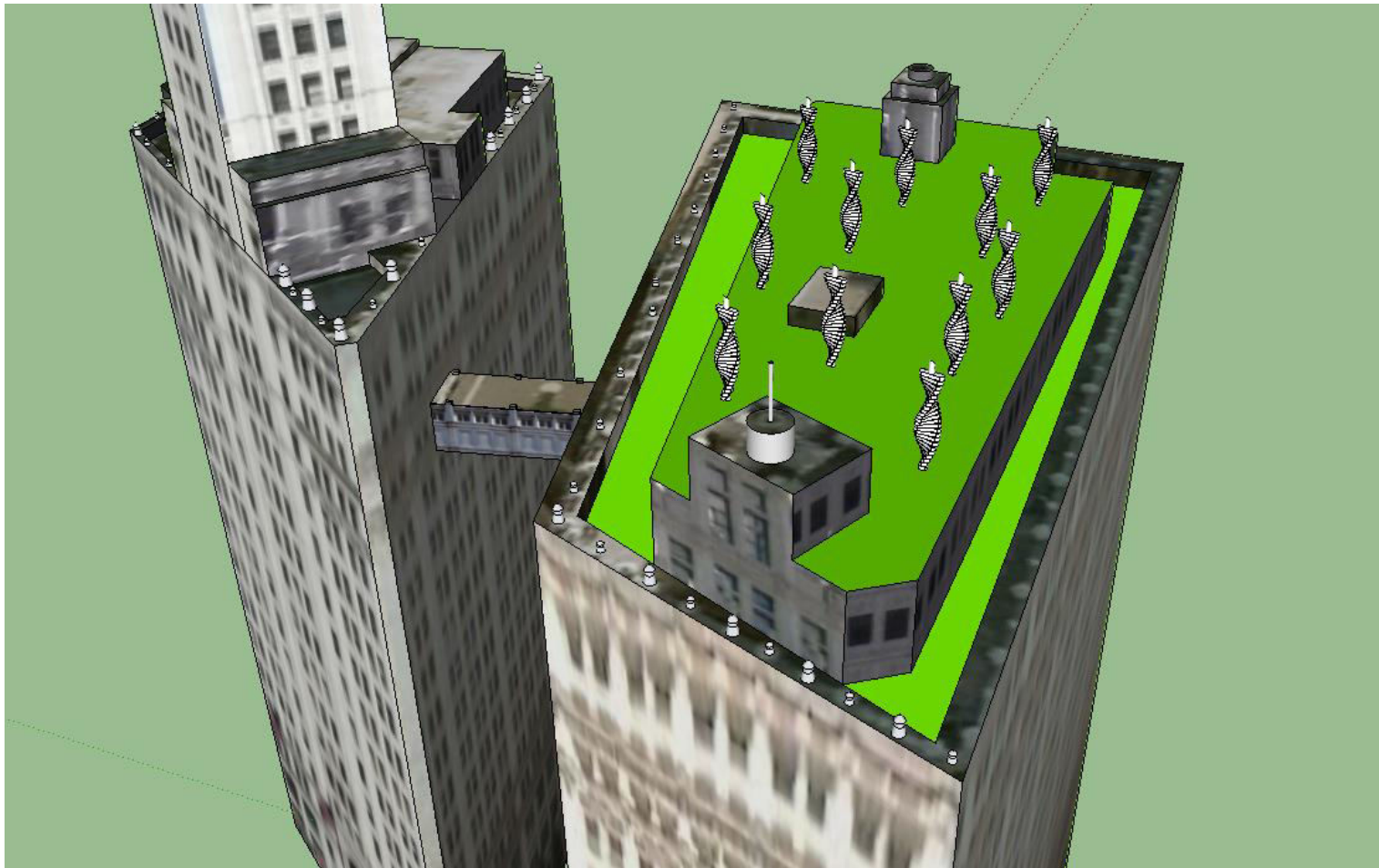
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Algunas preguntas?