Objectives

IPRO

Optimize the power output of a small scale wind turbine

Design and develop a custom turbine

Integrate wind turbines within building and cityscape design

Semester

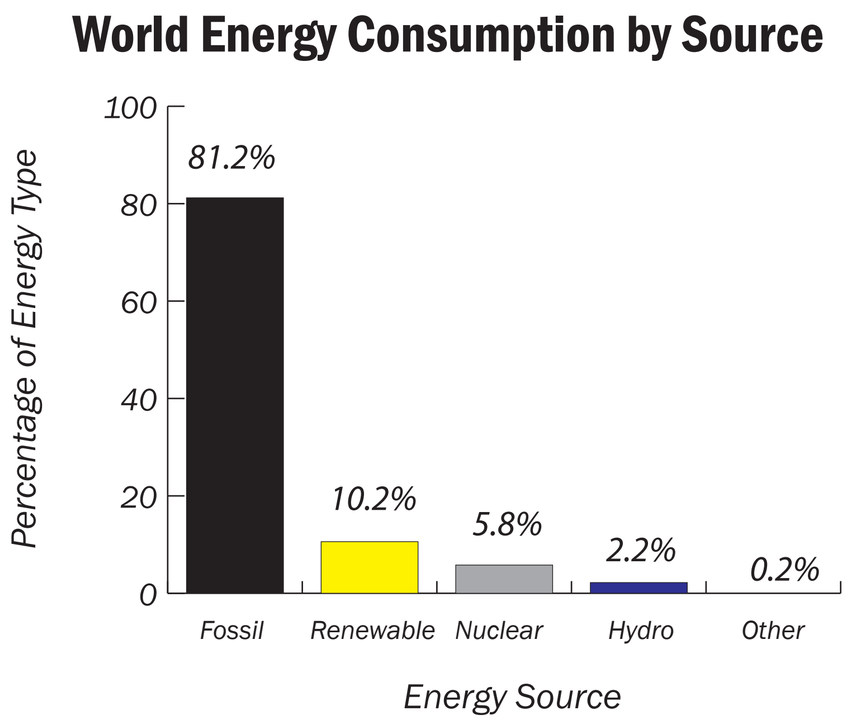
Develop a methodology for measuring the effects of velocity on power output

Digitally model a building with flow guidance surface design

Estimate the cost versus the benefits

Energy Consumption

Dependence and Impact of Fossil Fuels



The burning of fossil fuels produces roughly 21.3 billion tons of carbon dioxide per year

As the world population continues to grow so does the energy consumption of individual countries. One day fossil fuels will no longer be able to meet our energy needs

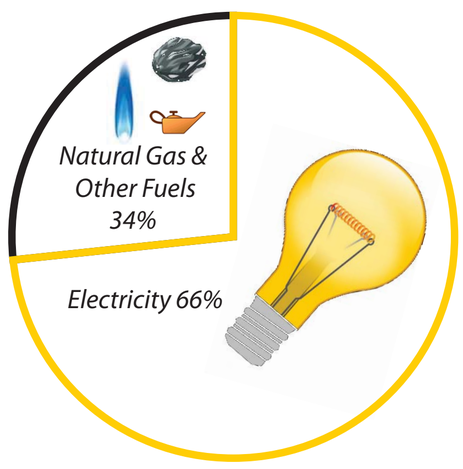
Technological breakthroughs have begun to provide an alternative path to energy production; wind power is growing at a rate of 30% annually

High Rise Energy Usage

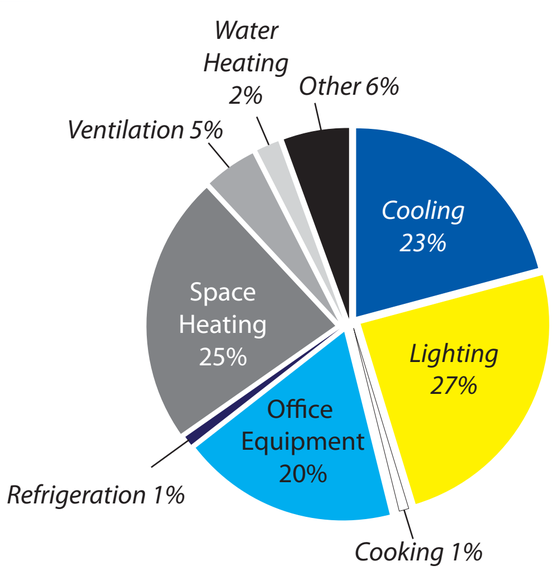
Dense urban environments account for 66% of the worlds total energy consumption

In the United States alone buildings represent 50% of the total national energy consumption and 77% of electricity use

Although tall buildings in large metro areas may consume large quantities of energy through proper design renewable energy sources may be incorporated into their design

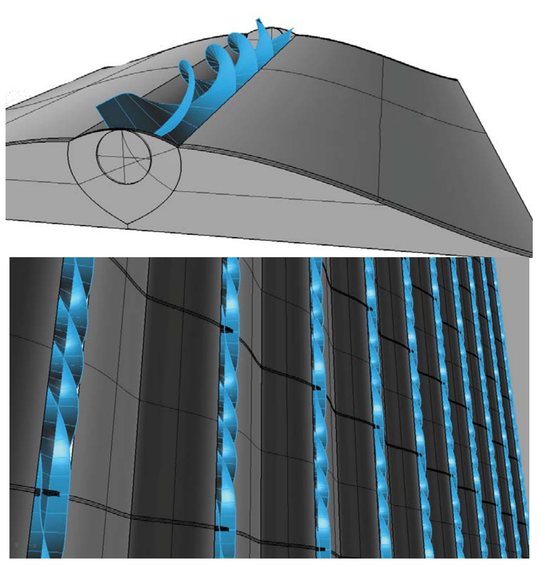


Electricity is the highest consumed resource within a typical high rise office building



Graphical representation of the break down of electrical consumption in a high rise office tower

Tall Building Design Techniques

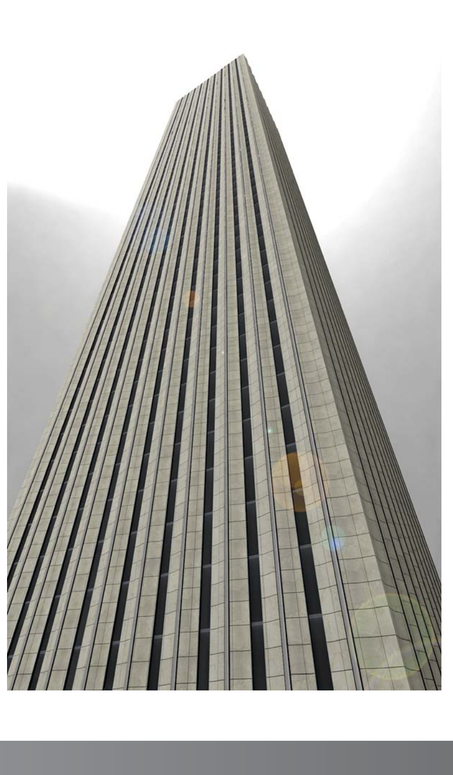


Horizontally placed turbines can be attached to the facade of a tall building to utilize the powerful wind forces skyscrapers typically encounter

Buildings typically encounter accelerated wind speeds across their facade and roof tops as they raise about the dense urban landscape

The shape of a building could potentially be manipulated to further accelerate the velocity of these winds to increase power output on turbines mounted on a structures roof or facade

Rendereing of a tower with facade mounted wind turbines on either side of the towers tined gray windows. Proper sizing of the dimensions of these windows allows for airflow to normalize in order to keep the needed accelerated wind speed to properly utilize the turbines power output.



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