

Art of Wind Power

IIT IPRO 314: InterProfessional Project

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SAIC SC4012: Future Green: Strategies for City Living



Abstract

Problem Description

This IPRO team project was a structured forum to guide and host an ongoing dialogue between key stakeholders on the appropriate application of wind power technologies in metropolitan Chicago. IIT and the School of the Art Institute of Chicago (SAIC) faculty and students represented expertise in architecture, engineering, visual communication, anthropology, business, art, design, urban planning and architecture. Representatives from the community, the private sector and the state were invited to contribute their areas of expertise and to provide feedback on preliminary conclusions made by the class. This project considered the array of impediments to and benefits resulting from the wider adoption of wind energy in metropolitan Chicago. The underlying concept is that there are many impediments to the introduction and expansion of wind energies in Chicago, but a multi-disciplinary conversation can pinpoint where individual or institutional actors can 'fill the gap' between the multiple stakeholders and actors to address these obstacles.

Overall Solutions

IPRO 314 represents a collaborative effort between three multi-disciplinary teams from IIT and the School of the Art Institute of Chicago. The three teams worked with professors, professionals and city officials over the span of the semester to develop three proposals that address various scales of wind-generated power production within the City of Chicago, including an individual architectural solution for a mixed-income housing project, a site-specific water purification proposal for Burnham Harbor and Northerly Island, and an integrated wind-powered brownfield remediation system for the Calumet-Sag Channel Industrial Corridor. All three teams based their work on the understanding that Chicago would be more likely to adopt wind power if the designs met several key criteria. Those criteria include:

- 1) Wind power generators are designed in such a way as to not detract from the visual quality of their setting.
- 2) Selected wind turbines are bird-friendly (i.e., pose not threat to migratory and non-migratory birds).
- 3) Power generated from the wind serves multiple purposes tied to ecological, cultural and economic need, including, but not limited to reduction of carbon emissions, economic revitalization, remediation of brownfields, stormwater mitigation, and others.
- 4) Wind power works collectively with other non-polluting, renewable energy sources.

Team 1 Results – “Wind rEvolution” in Brownfields Remediation

“Wind rEvolution” is a convertible wind power generating system designed in conjunction with other renewable energy sources to actively remediate brownfield sites for future development. **Wind rEvolution** proposes a collection of “plug-and-play” wind turbine systems that power remediation and development efforts in the Calumet-Sag Channel Industrial Corridor. This corridor contains many properties that fit along a continuum of remediation, including former industrial sites along the channel, the channel itself, which is a Superfund site, and 570 acres of recently remediated land that is slated for development, yet continues to pollute nearby waterways. **Wind rEvolution** integrates wind power into three of the stages along this continuum. First, portable wind turbines are used to power and provide supplemental energy for mobile plasma remediation units for highly toxic sites. In cases where toxins on a site cannot or should not be moved, these mobile units arrive on the site and remediate. Second, a wind farm on the 500+ acre USX/Southworks site uses the same adaptable wind turbine system to provide power to a permanent plasma solid waste disposal and electrical production facility and to the future development on the site. The turbines are designed to swap out as wind conditions on the site

change, and as the site is developed. Third, wind-generated electricity pumps water from the 68th Street Lake Michigan Crib to the South Water Filtration Plant, and drives a lake-cooling system that will provide air conditioning to the USX/Southworks site as it is developed. Through these three phases, **Wind rEvolution** promises to cultivate the sustainable redevelopment of this industrial corridor, while remaining adaptable in the future to other locations throughout the Chicago Region.

Team 2 Results – Wind Power and Open Space

The Northerly Island Wind and Water Project is an urban-scale installation for the city of Chicago that seeks to demonstrate the benefits of wind power while simultaneously improving the urban ecosystem and near-shore aquatic environment. We took as our inspiration three directives of the Chicago Lakefront Ordinance:

1. To maintain and enhance the predominantly landscaped, spacious and continuous character of the lakeshore parks.
2. To continue to improve the water quality and ecological balance of Lake Michigan.
3. To protect and develop natural lakeshore park and water areas for wildlife habitation.

With these directives in mind, the project proposes to place a series of wind-powered water pumps in Burnham Harbor that will circulate water from the Marina through several remediation processes aimed at oxygenation and cleansing of toxins. These processes range from the simple cycling of water through waterfalls and fountains for oxygenation, to more complex bio and phytoremediation processes in a system modeled after John Todd's Ecomachines, to retention and sediment filtration in a wetland system. The project also proposes to treat more toxic effluent from nearby park toilet facilities with the Ecomachine system. Excess energy from the turbines is intended to power parkland lighting in the surrounding area. A flywheel has also been proposed for storage. All of these systems are designed to enhance rather than interfere with the park and wetland system on Northerly Island, as well as to connect the island with the museum campus by integrating educational and cultural opportunities. Artistic and educational visualization are also an important part of the design, which is intended to reach beyond wind power to express Chicago's aspirations for a sustainable future.

Team 3 Results - Wind Power and the Built Environment

This project is an examination of the potential of wind power generation to be integrated into the architectural forms that make up the city of Chicago. We approached this project at two scales. *At an urban planning level:* What strategies can be applied to the design of the city to allow for maximum harvest of wind energy? *At the level of individual buildings:* What types of turbines are most appropriate to application to individual buildings and how can they be applied? How can architecture enhance their ability to generate power?

As a representative location of what makes Chicago a uniquely qualified city for the implementation of wind power the Lake Point Crescent development also framed this project with a socially responsible program and tangible client. We developed design goals that addressed the specific needs of the site in relationship to our research.

- 1) Maximize production of wind power through the comprehensive orientation of the Site and the individual building design.
- 2) Integrate wind power generation with an appealing community appearance.
- 3) Treat wind as an integrated component of a comprehensive alternative energy system.

A network of wind enabled residential structures at the scales of the single family home and row homes, eight-flats and two 17-story towers are proposed. Every structure is equipped with a system of turbines mounted to building forms that optimize access to wind and increase the speed of the wind as it passes through each turbine. The plan of the site takes into account the optimum orientation of the buildings for both wind and solar access in addition to significant neighborhood amenities such as the new park with bridge access to the lake. These design interventions will not only contribute significant amounts of green energy to the site, but also develop into an aesthetically pleasing vernacular that will create a positive identity for the neighborhood.

The Art of Wind Power Team Members

Team 1 Brownfield Remediation	Team 2 Open Space	Team 3 Built Environment
Bret Schneider (BFA)	Brendan Hudson (BFA)	Abdoulaye Diao (ChemE)
Charles McGhee Hassrick (MFA)	Cara Ellis (Arch)	April Chen (Arch)
Dong Hwan Kim (ME)	Jae Min Lee (Art and Tech)	Janusz Pula (EE)
Heidi Moran (BFA)	Michael Krauss (Arch)	Joon Park (ME)
Lisa Smith - (DesObj)	Rob Fleming (BFA)	Matthew Stewart (IntArch)
Segun David (EE)	Tor Kyaagba (EE)	Noel Wessely (MatSc)
Soo Ha (ME)		Steve Henry (Arch)
Supreedee Rittironk (Arch)		Thinh Nguyen (Arch)

Faculty, Staff and Professional Advisors:

- Mahjoub Elnimeiri, Ph.D., College of Architecture, IIT
- Frances Whitehead, SAIC
- Jacob Elster, Knapp Entrepreneurship Center, IIT
- Peter Ellis, AIA, Skidmore, Owings and Merrill
- Ray Clark, College of Architecture, IIT
- George Nassos, Stuart Business School, IIT