COMPANY

Tianjin Architecture Design Institute

LOCATION

Tianjin, China

SOFTWARE

Autodesk® Revit®
Autodesk® Insight™
Autodesk® CFD

Tianjin Architecture Design Institute Reaches Net-Zero With BIM

> Only by using BIM could we reach our core goal of zero energy consumption. The inspiring design and purpose of the center, combined with the commitment to sustainability, makes the project an important contribution to the community.
>
> — **Zhang Jinyi**
> Vice President
> Tianjin Architecture Design Institute

Image courtesy of BIM Design Center, TADI.

BIM for sustainability

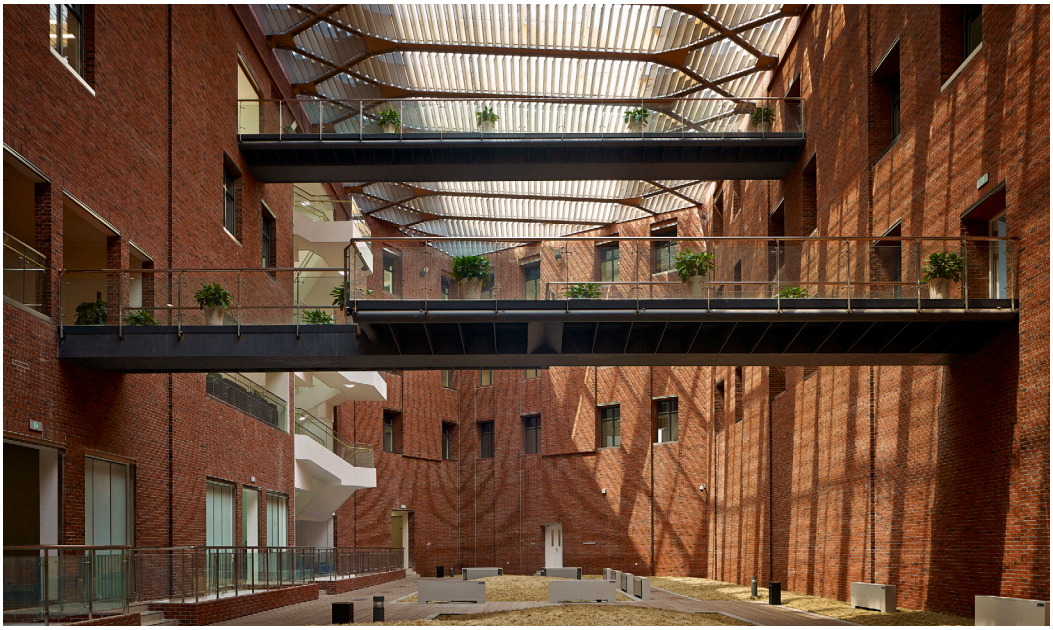
Jie Fang Nan Lu Community Culture and Sports Center is dedicated to public welfare—both physically and culturally. With a total construction area of 11,659.5 square meters, it includes a natatorium, badminton courts, lecture and multi-functional halls, gymnasium, conference halls, a community school, and more. The center is also designed for maximum sustainability and to operate as a net-zero building, obtaining both LEED Platinum and China's Three Star certifications.

Built for the community's residents, the center must not only operate at a low cost and with zero energy consumption, but also serve as an inspiration to build more sustainably for other projects in the area. To meet these goals, Tianjin Architecture Design Institute used BIM from the very beginning to realize the most sustainable building possible with energy consumption reduced to 765 MWh/year and renewable energy production reaching 870 MWh/year.

Achieving sustainable design

With BIM, the team set out to design a building suitable for the area's climate, the location, and function for low-impact development as well as an innovative MEP system to reduce energy consumption. They first started with four different designs. Based on the evaluation of lighting, wind, heat, topography, and more, the ideal design was chosen along with the use of renewable energy sources such as solar and geothermal energy to reach their targets. All stakeholders could also be provided direct updates to the model, including any analysis data from each specialty in real time.

The simulations and analysis were crucial to improving the design. Field simulation and analysis of light guided the climate response design. By the analysis of interior functions and indoor lighting, the window openings were optimized. Shading and lighting uniformity determined the elevation. Based on IES analysis data through the energy consumption simulation, the window-to-wall ratio alone was calculated and determined



Images courtesy of BIM Design Center, TADI.

for an interval of 30-40 percent and energy consumption reduced by 4.1 percent after optimizing that ratio.

Through the simulation of wind outside the building, a tunnel was created in the atrium to bring air inside. The atrium itself creates its own microclimate that also supports the temperature of other rooms. The data of solar photovoltaic panel power generation were also calculated; a detailed analysis model was built for a 15-degree sloping roof, along with the total monthly electricity output in a year calculated according to the local climate conditions.

Central model drives collaboration

From start to finish, the Jie Fang Nan Lu Community Culture and Sports Center makes full use of BIM across all specialties to share information. The 3D collaborative design of the complex space helped to overcome information barriers and improve the design in a visual environment. With all of the simulation data vividly expressed in the model, the architecture team could quickly understand it and update the model easily.

Through the continuous improvement of the model, negative space and design errors were reduced. With the complete expression of the model information in the drawings, it has eliminated most of the rework and demolition issues typically encountered. Construction costs were significantly reduced through this single look at the project as well as the use or recycled and local materials with the end goal of the most sustainable project possible for the community.

Second place winner of the AEC Excellence Awards 2017

Global projects that embrace connected BIM technologies and sustainable design in Architecture, Engineering, and Construction

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