Demonstration Building with Solar Photovoltaic-Electricity-Thermal Sequential Conversion (Building No. 7 of the iHarbour* campus, Xi'an Jiatong University, China)

To achieve future-oriented experimental research and talent training in the field of Zero-net carbon building design, the faculties and students from School of Human Settlements and Civil Engineering (HSCE), Xi'an Jiaotong University (XJTU), China jointly and independently designed the project of Building 7 of the iHarbour campus of XJTU and took part in the project supervision in the construction of Building 7. The project maximized the value of building performance through a variety of innovative designs.

First, a solar photovoltaic-electricity-heat conversion double-layer enclosure structure and its internal flow control technology, integrated with indoor environment control was developed to realize the solar photovoltaic production of all kinds of the outer surface of the building. This new design can be defined as the envelope integrated PV/T system (EIPV) by integrating and fusing solar photovoltaic technology with the building envelope to expand the solar energy utilization potential of the building façade.

Second, the solar chimney combining active and passive design, including a solar photovoltaic/photothermal integrated energy storage system for chimney wall heating module and solar photovoltaic-driven active ventilating fan module, was used to enhance the effect of solar energy chimney.

Third, the ventilation tunnel combining active and passive design with shallow buried pipes and underground corridors realized the dual utilization of geothermal energy, which can be applied to cooling and ventilating building rooms in summer, ventilating buildings in excessive seasons, and preheating air in winter.

In addition, the fully detachable assembled façade design was developed oriented to the maintenance and transformation of the whole life cycle of the building, which can provide an experimental platform for the evaluation of application scenarios during the development of façade insulation materials and insulation structures.

Finally, Building 7 was designed and constructed with the participation of students and faculties. In the future use phase, experimental research oriented to the development of low carbon building technology will also be conducted by students and faculties. Therefore, as a platform for training innovative talents about low-carbon building, this program can continuously contribute talents to the development of related technological innovation.

*iHarbour—innovation harbour