

## **The thermal and economic characteristics of solar air collectors with different delta turbulators arrangements**

The benefits of using a solar air collector with different array delta turbulators absorber plates are experimentally investigated to assess this type of collector under western and middle of Iraq climate conditions. The solar collector was investigated with four different absorber plates in which flat plate, in-line delta turbulators, staggered delta turbulators and inclined staggered delta turbulators with different mass airflow rates. The economic characteristics and overall thermal performance of the collector are compared with other heating systems. The major findings show that the delta turbulators enhance the economic characteristics and the overall thermal performance of collectors due to vortex generation and damping the development of the thermal boundary layer in the direction of airflow. A substantial enhancement is observed in lowering both life-cycle costs and increasing energy saving with delta turbulators. This study will likewise provide a new direction to the work trend in western and middle of Iraq climate conditions during winter days.