

# Comparison of energy consumption and greenhouse gas emission footprint caused by agricultural products in greenhouses and open fields in Iran

## ABSTRACT

Decisions can be taken to increase energy efficiency and to mitigate emission to the environment by examining the energy audit and the greenhouse gas (GHG) emission footprint of crop production in different ways and in different regions, which have comparable principles. In this study, the energy consumption and energy indices of tomato production in four regions of Iran, which include an East Azerbaijan province (open-field system), the provinces of Kermanshah, Tehran, and Isfahan (greenhouse system) were compared using data from related articles. Chemical fertilizers and the irrigation water used in tomato production in open fields, and the diesel fuel and chemical fertilizers used in tomato production in the greenhouse system were the greatest energy consumers in Iran. The energy consumption of irrigation water for tomato production in an open field was markedly higher than tomato production in a greenhouse. In this study, the GHG emission footprint inputs of machinery, diesel fuel, chemical fertilizers, chemicals, plastics, and electricity used in the production of tomatoes were calculated via coefficients related to GHG emission. The highest and the lowest greenhouse gas emission during tomato production in greenhouses in farms within the provinces of Tehran and East Azerbaijan were determined to be 13661.37 kgCO<sub>2</sub>eq ha<sup>-1</sup> and 1274.02 kgCO<sub>2</sub>eq ha<sup>-1</sup>, respectively. Overall, tomato production in open fields leads to lower greenhouse gas emission and energy consumption per unit area, but according to the greater energy output in the cultivation of tomatoes within a greenhouse, the energy efficiency of tomato production in greenhouses was higher.

**Keywords:** Energy efficiency; Energy audit; Environment; Pollutants