

Faculty and PostDoc, Science and Engineering

# Food, Energy and Water management innovation in Doha: a design-led nexus approach

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## 1. Introduction

Urban communities are vulnerable to food, energy and water demand since they are affected by population growth, urbanization and climate change. According to United Nations<sup>1</sup>, the world's population is expected to increase by 2 billion persons in the next 30 years from 7.7 billion currently to 9.7 billion in 2050 and 68% of them are projected to live in urban areas by then. At the same time, 1/3 of the food produced in the world for human consumption every year gets lost or wasted and still, 795 million people worldwide are malnourished<sup>1</sup>. A sustainable FEW Nexus is of critical need.



Source: (1)

## 2. Aims and objectives

The Moveable Nexus Project is aiming to give a solution to the FEW Nexus through urban design methods and urban agriculture practices, together with stakeholders and the community's participation. Its mission is to develop and practice the design method, evaluation effect and participation<sup>2</sup>. The design method will be practiced through design charrettes and international workshops and the evaluation will be realized by a Food, Energy & Water consumption environmental footprint calculator. Finally, the participation phase will engage all interested members at the Doha Living Lab.

## 3. Qatar University Campus FEW Nexus facts

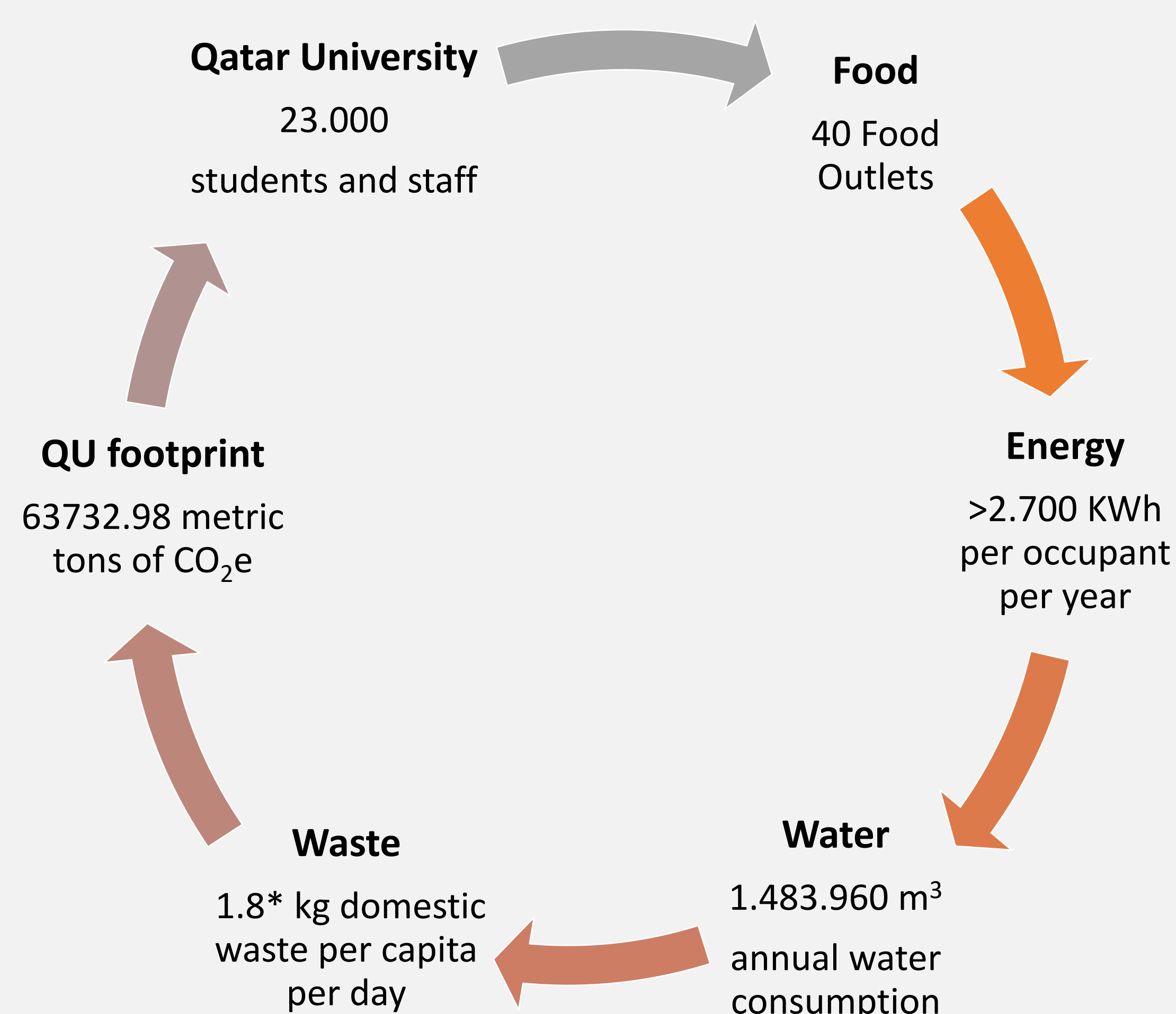


Figure 1: Food, energy, water, waste components and carbon footprint for Qatar University. Source: (3),(4),(5),(6)\*National average

## 4. Doha Living Lab Concept

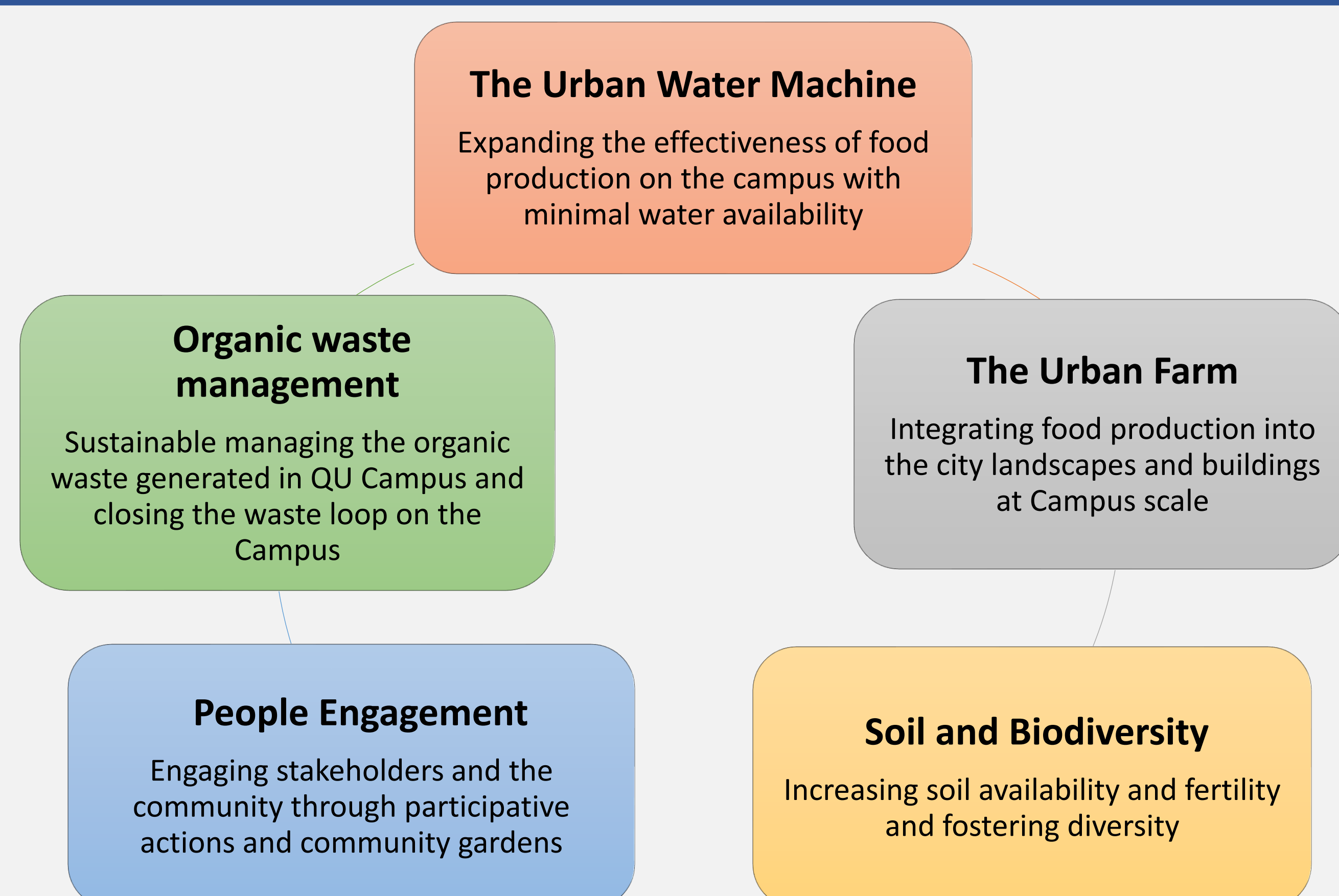


Figure 2: The Doha Living Lab concept and highlights for Qatar University Campus.

## 5. Methods

### A Organic Waste Management

The food and agricultural waste generated in the Campus will be sustainably managed through on-site composting by using two different composting methods. The produced compost will be used to the Living Lab open field and net house trials.

### B Open field cultivation

Sustainable open field cultivation of aromatic plants and herbs. The produced compost will be used as a soil amendment, enhancing soil fertility and encouraging biodiversity.

### C Net house cultivation

The urban scale net house will be of simple construction with a shading system and no cooling system, thus with low energy consumption. Vegetables will be grown the local growing season between October and May, under the hydroponic system in growth bags using the produced compost. Microalgae will be cultivated with the use of a photobioreactor and an immobilized system inside the net house.

## 6. Evaluation tool

The environmental footprint of Food, Energy and Water (FEW) resources consumption and waste processing is calculated in an urban context in two scenarios: present situation and future predictions. Table 1 shows the food, energy, water consumption and waste generation data of recent years for the community of Doha, Qatar. Analyzing these data, the carbon footprint for each resource is calculated, with the electrical energy having the highest CO<sub>2</sub> footprint, followed by the food sector. The CO<sub>2</sub> footprint per capita is estimated up to 11672 kg (Table 2). Future predictions on the environmental footprint depend on the choices the community makes towards a more sustainable lifestyle.

Table 1: Food, energy, water and waste components for Doha, Qatar.

Food, energy, water and waste components for Doha, Qatar	
Food consumption per capita (main food groups)	1470 gram/day
Total energy community consumption	4618043332 [unit/yr.]
Total water end-use community consumption (general use)	75541641 [m <sup>3</sup> /yr.]
Total water end-use community consumption (DW consumption)	54138176 [m <sup>3</sup> /yr.]
Domestic waste per person	657 [kg/cap/yr.]
Total waste generated in community	226624.9 [ton/yr.]

Table 2: Present situation (2020) carbon footprint for Doha, Qatar.

Food, Energy & Water carbon footprint for Doha, Qatar in 2020	
Qatar Doha Population	344939
Households	73391
Food	530236 [ton]
Energy, Electrical/Thermal	2752354/652 [ton]
Mobility	351 [ton]
Water	505471 [ton]
Waste	237108 [ton]
Total carbon emission	4026171 [ton]
Per capita carbon emission	11672 [kg]

Source: (7),(8),(9)

## References

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