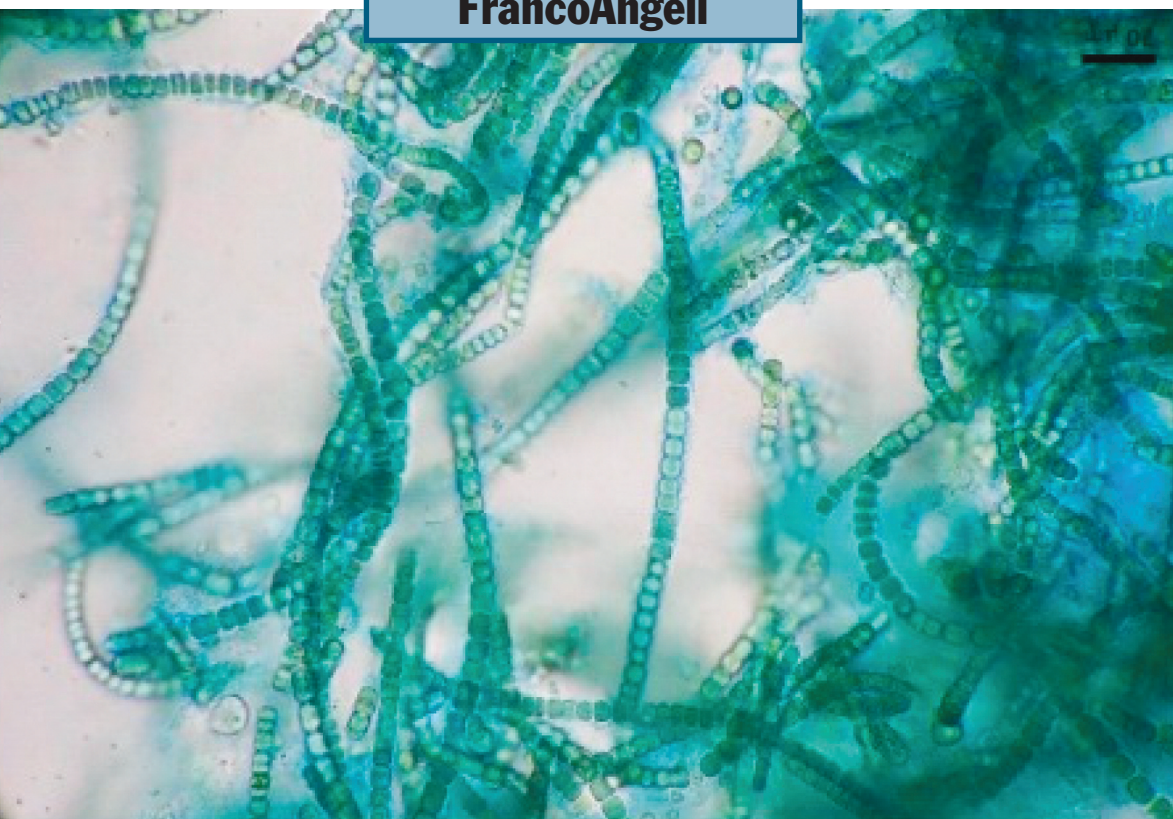
Fiammetta Costa, Attilio Nebuloni
(edited by)

THE JETSONS' KITCHEN

A ZERO-MILE SYSTEM FOR WASTE WATER RECYCLING AND CULTIVATION

FrancoAngeli



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This book has been realized in the frame of a research named “Design for sustainability and ICT: a product system for waste recycling in home environment” funded by Politecnico’s Fondo d’Ateneo per la Ricerca di Base 2016 (FARB) del Politecnico di Milano.

The name Jetsons’ Kitchen comes from a quotation by Luciana Migliore.

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Appendix

The Jetsons' kitchen. A brief synopsis

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Zero-mile food production is gaining in popularity worldwide, due not only to greater awareness of the environmental impact of food transport, but also to expanding interest in healthy and sustainable diet trends. Following this trends, growing zero-mile vegetables as part of urban and architectural greening projects generates various benefits in terms of perception and environment. Aesthetic benefits are evident in the composition of vertical partitions and horizontal roofing, while in environmental terms such greening improves air quality and the urban climate with consequent energy savings. In this context, innovative forms of agriculture, which have been termed Zero-Acre Farming (ZFarming), are emerging in cities in addition to the renewed emergence of more traditional community gardens, providing people with space to grow their own food. These new forms of green urban architecture, which are characterized by zero land use or acreage, include rooftop farms and greenhouses, indoor farms, and other building-related solutions. This trend has contextually originated new interest in strategies and processes to promote the valorization of domestic wastewater.

Indeed, ZFarming can exploit wastewater that is already available on-site, since irrigation with reclaimed wastewater, not only reduces the consumption of fresh water, but also the use of fertilizers. Domestic wastewater is typically rich in mineralized nutrients, and peri-urban agriculture has historically benefited from the absorption of these nutrients. On a smaller scale, kitchen wastewater reuse has traditionally been practiced in rural communities.

The research described here sets out to update such practices to make use of the high nutrient content in kitchen wastewater, which is low in pathogens, heavy metals and pharmaceuticals.

Integrating vegetable cultivation in the domestic environment with reusing kitchen wastewater for irrigation is a promising strategy for reducing household freshwater consumption, as it limits the amount of wastewater to be treated by up-cycling nutrients for growing plants, produces healthy plant food and raises environmental awareness among citizens. A first step in this direction is the experimental project to reuse dishwasher effluents described in this book.

Dishwasher effluents were chosen as an initial bench test because of their high nutrient content, low harmful elements and constant wastewater quantity and quality. Further studies are planned to develop such systems at the kitchen, household, and community level. Here, wastewater treatment may consist of a combination of several chemical, physical and biological processes such as aerated lagoons, activated sludge or biofilms in trickling filters. Studies for the development of a domestic biofilter containing a consortium of microalgae and heterotrophic bacteria are also presented.

The book brings together a series of considerations by an interdisciplinary group of researchers from the Politecnico di Milano, Università Statale di Milano and Università di Roma Tor Vergata, ranging from biology to design through sociology and composition. They focus on the potential application of such processes as part of a new system which has been named ZERO MILE.

The first chapter describes some general aspects of the system, from expected results to the biological components needed for its development (Costa *et al.*). It is followed by an in-depth study of the biological filter itself, which will help to establish the design requirements to be adopted in the experimental prototype phase (Migliore *et al.*). On a larger scale, the third chapter focuses on the system's social dimension, investigating users' habits and ecological aspects (Volonté, Grana). The next chapter concerns the development of an experimental prototype at the domestic kitchen scale (Costa *et al.*). The final chapters document potential application scenarios in the building context (with an appendix of case studies and the generative processes used in their design by Nebuloni and Meraviglia) and on a larger scale a discussion of possible extensions to the urban environment (Costa *et al.*).

Benefits of implementing the system at the various project scales include:
1. Domestic or local production of non-contaminated vegetables. On-site production stimulates user participation, supports healthy eating habits, and contributes to a sustainable diet, decreasing the environmental impact of food production.
2. Reduced fertilizer use. Reclaimed wastewater is rich in mineralized nutrients obtained through biofiltration, which boosts plant growth.
3. Lower freshwater consumption and reduction of the amount of wastewater to be treated. The reclaimed wastewater is exploited for plant irrigation instead of using fresh water.
4. Perception of the water cycle and environmental awareness. Active involvement in wastewater recycling may trigger a broader cultural change in consumer attitudes, encouraging a transition from a linear to a regenerative, circular water economy.

The system, which is essentially grounded in the concept of the circular water economy, not only aims to stimulate a change in people's lifestyles and enhance daily living spaces, buildings and urban environment, but may also find potential applications in confined and extreme environments, such as refugee and emergency camps or Antarctic bases and space stations.

Notes

This book presents results research made possible thanks to the contribution of Politecnico di Milano (Fondo di Ricerca di Ateneo and Fondo d'Ateneo per la Ricerca di Base) and Regione Lazio (Programma Torno Subito). The name Jetsons' Kitchen comes from a quotation by Luciana Migliore referring to the futuristic kitchen of the Hanna-Barbera cartoon.

The book aims to investigate the up-cycling of domestic effluents for plant production, bringing together a series of considerations by an interdisciplinary group of researchers from the Politecnico di Milano, Università Statale di Milano and Università di Roma Tor Vergata, ranging from biology to design through sociology and architectural composition.

Integrating vegetable cultivation in the domestic environment with reusing kitchen wastewater for irrigation is a promising strategy for reducing freshwater consumption, limiting the amount of wastewater to be treated producing healthy plant food and, ultimately, raising environmental awareness among citizens. A first step in this direction is the experimental project to reuse dishwasher effluents in living spaces (kitchen, household, and community level), as described in the book. Dishwasher effluents were chosen as an initial bench test because of their high nutrient content, low harmful elements and constant wastewater quantity and quality, where treatment may consist of a combination of several chemical, physical and biological processes. Studies for the development of a domestic biofilter containing a consortium of microalgae and heterotrophic bacteria are also presented.

Fiammetta Costa, PhD in Industrial Design and researcher at the Design Department of Politecnico di Milano. Principal areas of her research interests are user research methods and environmental design. She has been teaching Ergonomics and Industrial design since 2000 at the School of Design of Politecnico di Milano.

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