



CleanTech

Inspiring High School Students in STEM, Sustainability, and Careers in the Emerging Green Economy

FOOD





CleanTech

Inspiring High School Students in STEM, Sustainability, and Careers in the Emerging Green Economy

FOOD

ACKNOWLEDGMENTS

ABOUT SOLAR ONE

“Green Energy, Arts, and Education Center.” We inspire New Yorkers to become environmentally responsible city dwellers. Solar One offers innovative programming to K-12 students throughout all 5 boroughs of New York City in the areas of renewable energy, sustainable design, estuarine ecology and environmental art.

The mission of Solar One’s education program is to facilitate applied experiential learning opportunities through science, design, art and entrepreneurship. Our staff of educators are here to help you make the Green Design Lab an integral part of your school’s curriculum and learning objectives.

Cleantech is Solar One’s High School curriculum that engages students in sustainable design, problem solving, and innovation in the emerging green sector. Cleantech was made possible through generous funding provided by The Rockefeller Foundation and the National Science Foundation under Grant No. DRL-1139308.

The Green Design Lab™ is also generously supported by our founding sponsors including Con Edison, The Mertz Gilmore Foundation, HSBC USA, N.A., the JC Kellogg Foundation, the Schmidt Family Foundation 11th Hour Project, and the Leslie and Daniel Ziff Family Foundation. We would also like to thank our partner, the New York City Department of Education Sustainability Initiative.

VISIT US ONLINE AT SOLAR1.ORG

The Green Design Lab™ © 2012 Solar One - New York, NY
The Green Design Lab™ is a trademark of Solar One. All rights reserved.

Except for Activity Worksheets and Readers, no part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, or any other information storage and retrieval system, without written permission from Solar One. Reproduction of Activity Worksheets is for educational purposes only.

Publisher: Solar One
Solar One Green Energy, Arts and Education Center
24-20 FDR Drive, Service Road East
New York, NY 10010
Tel. (212) 505-6050

CURRICULUM ADVISORS

Solar One gratefully acknowledges the insightful guidance provided by our distinguished Cleantech Steering Committee. Thought leaders in the field, they provided input on everything from big picture thinking and pedagogy to fact checking and typos. *Thank you!*

CLEANTECH STEERING COMMITTEE: **Jill Andersen** (Director of Policy and Chief of Staff, NYPA), **Kathy Boden** (VP, Gas Operations, Con Edison), **Bill Browning** (Founder, Terrapin Bright Green), **Toby Cumberbatch** (Professor, Cooper Union), **Micah Kotch** (Director of Operations, NYC ACRE at NYU-Poly), **Denise McNamara** (Secondary Science Instructional Specialist, NYC Department of Education), **Halton Peters** (Neon), **Pat Sapinsley** (President, Build Efficiently), **Robert Wyman** (Google)

FOOD CURRICULUM REVIEWERS: **Joe Evans**, **Sean T. Dixon, Esq.** (Clean Ocean Action), **Jane Hodge** (Farm School NYC Director, Just Food)

CURRICULUM DEVELOPMENT

Fronsy Thurman, Assistant Director for Instruction
Esther Siskind, Director of Programs
Sarah Pidgeon, Director of NYC K-12 Education
Joe Chavez
Alex Smith

REVIEWERS

Chris Colins, Executive Director
Sarah Holloway, Senior Consultant

BOOK DESIGN: Adam Bezer



Any opinions, findings, and conclusions or recommendations expressed in this material are those of Solar One and do not necessarily reflect the views of the National Science Foundation.

TABLE OF CONTENTS

Page	vi	INTRODUCTION
	vii	CURRICULUM MAP
<hr/>		
	01	Lesson 1: Food Systems
	09	Lesson 2: Industrial Agriculture: The Business of Food
	22	Lesson 3: Processed Food, Health and Nutrition
	48	Lesson 4: The Science of Soil
	60	Lesson 5: Population and Food Production
	82	Lesson 6: Towards a New Food System
	99	Lesson 7: Food Production for an Urbanizing World
	110	Glossary

INTRODUCTION

CLEANTECH FOOD is an innovative high school curriculum that uses a comprehensive approach to integrate study across the multidisciplinary field of food studies. Designed to increase student awareness and knowledge of the science, issues and emerging trends and technologies affecting food systems, CleanTech Food contains the most current information and research available along with relevant and engaging student-led activities. The Unit begins with an overview of the food system and its impacts. Equipped with this foundational knowledge, students take a more critical look at our current methods of food production through an investigation of industrial agriculture and its environmental, social and economic impacts, including close study of biotechnology, processed food and nutrition. The curriculum surveys trends in population growth and its projected impacts on global food production. Students explore concepts of carrying capacity and exponential growth, and are given opportunities to analyze existing trends and evaluate future challenges to the global food supply. The focus of the curriculum then shifts to methods and innovations in sustainable agriculture for a rapidly changing world. Providing a template for career exploration, the hands-on sustainable agriculture activities allow students to explore principles of sustainable agriculture and emerging technologies in food production through the application of classroom concepts to real-world problem-solving. CleanTech is a wide-range curriculum that supports Science, Technology Engineering and Math (STEM) skills, while encouraging student interest and participation in a sustainable future.

HOW TO USE THE CURRICULUM MAP

CleanTech Food offers a wide array of activities and resources, covering topics ranging from food systems to soil science to population growth and the global food supply. Each lesson is designed to work independently or as part of a larger course of study, allowing teachers to tailor CleanTech Food to meet the individual needs of their classroom. Curriculum activities are grouped into three categories:

GENERAL ACTIVITIES emphasize the foundational knowledge and general concepts of food-related fields of study, from food production to nutrition. Hands-on projects and investigations stress comprehension and application of classroom knowledge. These activities are appropriate for all grades as an introduction to the topic.

ACCELERATOR ACTIVITIES center on policy, economics, and technology, with the purpose of introducing students to the complex issues surrounding food production and consumption. These activities are research-oriented and stress analytical thinking, encouraging students to synthesize and evaluate information from a variety of sources. Accelerator activities involve data analysis and may be appropriate for older grades. Computer access is strongly advised for certain activities.

GREEN SKILLS ACTIVITIES are modeled on career and technical training for careers in the green industry. They focus on developing hard skills and the knowledge base required for real-world application.

The Curriculum Map is intended as a guide to help schools and teachers navigate the curriculum to develop dynamic and engaging study for their students. For all participating classes, it is encouraged to try as many activities as possible.

CLEANTECH FOOD CURRICULUM MAP

FOOD LESSONS AND ACTIVITIES	General	Accelerator	Green Skills
Lesson 1: The Food System			
Activity 1A: Food Miles	•	•	•
Lesson 2: Industrial Agriculture: The Business of Food			
Activity 2A: Public Forum on Biotech		•	
Lesson 3: Processed Food, Health and Nutrition			
Activity 3A: Decoding Labels	•		
Activity 3B: Designing a Daily Diet		•	
Activity 3C: Community Food Survey	•	•	•
Lesson 4: The Science of Soil			
Activity 4A: Soil Lab	•		•
Lesson 5: Population and Food Production			
Activity 5A: Yeast Population Demonstration	•		•
Activity 5B: Understanding Exponential Growth	•		
Activity 5C: World Food Summit		•	
Activity 5D: Global Food Supply Strategies		•	
Lesson 6: Towards a New Food System			
Activity 6A: Build a Sustainable Farm	•		•
Lesson 7: Food Production in a Changing World			
Activity 7A: Design an Aquaponic System		•	•

CLEANTECH, SOLAR ONE'S HIGH SCHOOL CURRICULUM,

engages students in sustainable design, problem solving, and innovation. Through hands-on learning, students explore emerging clean technologies and sustainability-related policy and economic issues at the local, national and global level. Cleantech is designed to inspire the next generation of green engineers, scientists, architects, building system managers, energy auditors, economists and entrepreneurs.

Cleantech is an integral part of Solar One's Green Design Lab™, the only curricular blueprint of its kind that looks at the school building as both a laboratory for learning and a tool for environmental change. CleanTech expands on the core concepts of the existing Green Design Lab interactive curriculum with more advanced and technical content. It introduces students to the Cleantech industry through STEM (Science, Technology, Engineering & Math) focused reading material, research projects and hands-on labs. Through four units – Energy, Materials, Water and Food – students learn about topics like electric grid transmission, renewable energy, battery storage, demand management water technologies, biomimicry, stormwater management, and hydroponics, to name a few. In addition to addressing the foundational aspects of these four subjects, CleanTech offers Accelerator activities that cover a broad range of science, economic and policy research topics, and Green Skills activities that focus on developing hard skills in such areas as renewables and hydroponics.

The Food Unit introduces students to the multifaceted field of food studies. Designed to increase student awareness and knowledge of the science, issues and emerging trends and technologies affecting food systems, the Food Unit contains the most current information and research available along with relevant and engaging student-led activities. From investigating conventional food production and distribution to exploring methods of sustainable agriculture, the Food Unit takes a comprehensive look this fundamental yet complex topic.

