

**SUSTAINABLE
TECHNOLOGIES**

Trades, Advanced Technologies and Sustainability at SFCC



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July 30, 2021

VIRTUAL DISTRIBUTED
ENERGY SUMMIT 2021
- MODERNIZING NEW
MEXICO ENERGY



- ~ 6,500 credit students
- 70% over 25 years old
- 50% have children
- Public school drop-out rate near SFCC – 40-50%
- 75% Part time
- 62% Female
- 45% Hispanic
- 7.5% Native American

• 2015-2019 Best for Vets: Career and Technical Colleges





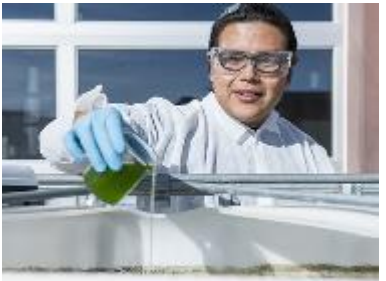
Biofuels

Biogas

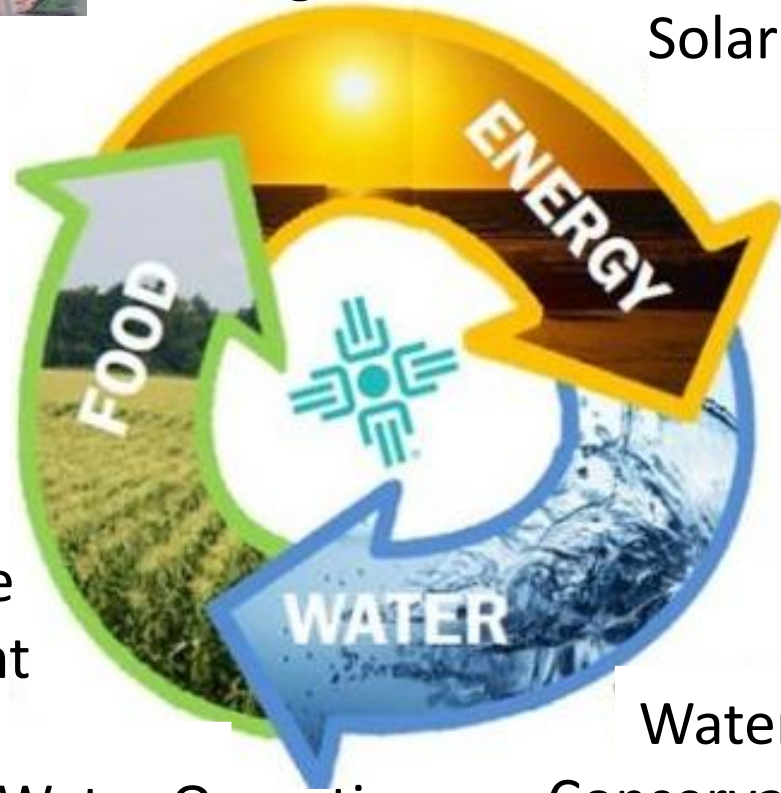
Solar Energy

Distributed Energy

Controlled Environment Agriculture



Algae Cultivation



Energy Efficiency



Plumbing/HVAC

Welding



Construction Trades
Green Building

Greenhouse Management



Aquaponics

Water Operations

Water Conservation



¿What is Sustainability?

“sustaining the underlying pattern of health, resilience, and adaptability that maintain this planet in a condition where life as a whole can flourish” – *Daniel Christian Wahl*

"a ... global society founded on respect for nature, universal human rights, economic justice, and a culture of peace" – *The Earth Charter*

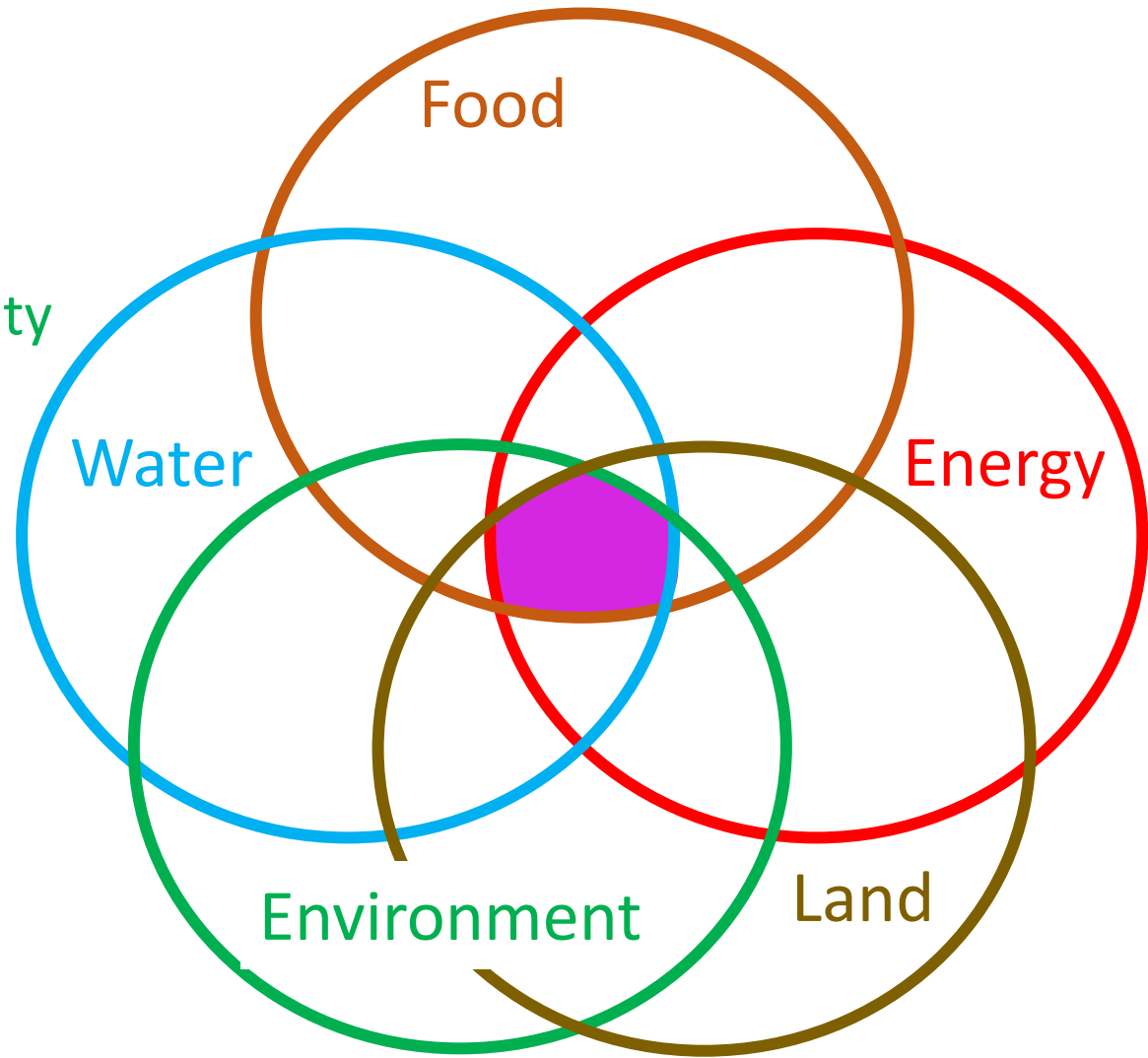
“Sustainability is improving human well-being and ensuring social equity for present and future generations while safeguarding the planet’s life-supporting ecosystems.” – *Chris Boone*

“Corporate Sustainability is a business approach that creates long-term shareholder value by embracing opportunities and managing risks deriving from economic, environmental and social developments.” – *Dow Jones Sustainability Index*

“sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” – *Brundtland Commission*

¿What is Sustainability?

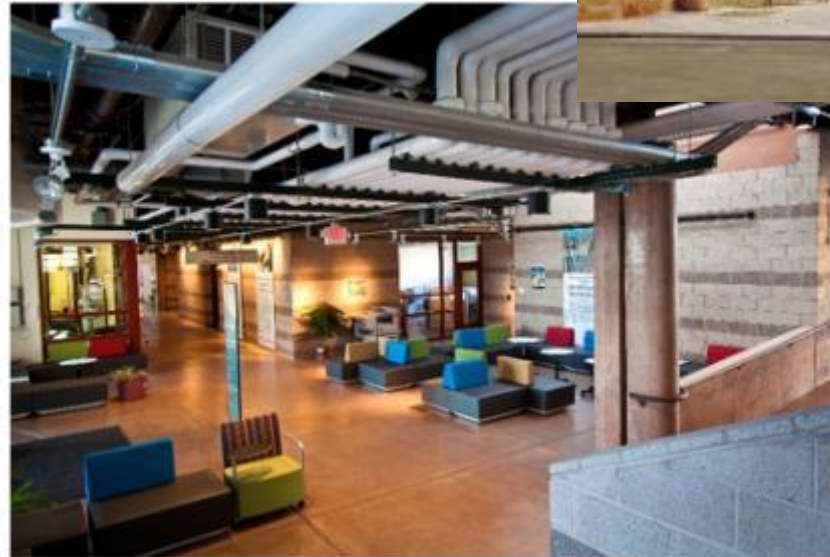
- Food Sovereignty
- Energy Sovereignty
- Land Sovereignty
- Environmental Sovereignty
- Water Sovereignty



Sustainable

Trades and Advanced Technologies Center

- LEED® Platinum – US Green Building Council
- 42,000 ft² “living” laboratory
- Rooftop rainwater catchment for lavatories
- Motion sensing lights – 96% LED
- Skylights with fiber optic tubes
- 75% of project’s energy costs offset by on-site renewable energy generation



Biofuels



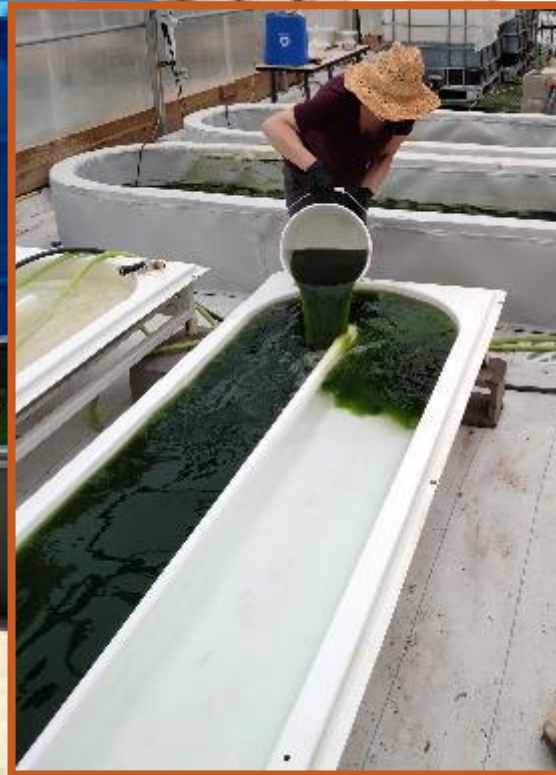
Controlled Environment Agriculture



Water Operations



Algae Cultivation



Distributed Energy Systems

SFCC CAMPUS MICROGRID

Siemens Microgrid Controls

1.5 MW Solar PV

1 MW Nat Gas Generator

Siemens Switchgear

1 MW Li Ion BESS

UTILITY

GREENHOUSE NESTED INSTRUCTIONAL MICROGRID

Microgrid Controller plus Simulation

12 kW Solar PV

100 kW Li Ion Battery Energy Storage System

Campus Loop Energy and Communications

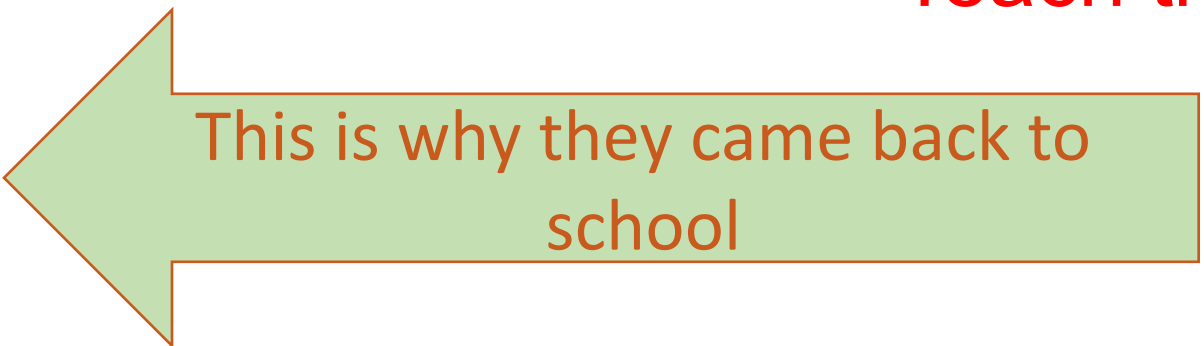
BEAM Training Center
Building Energy Automation and Microgrid



Stealth STEM

- Students re-entering the community college system DO NOT want an “education”
- They want a good-paying stable JOB!!!!
- The traditional academic system does not serve their needs:
- Traditional order in college programs:
 1. General education courses
 2. Core courses
 3. Specialized courses
 4. Degree

Teach this first!!



This is why they came back to school

Stealth STEM

1st Semester

- New students
 - “I don’t need biology to learn how to grow algae”
 - “I can’t do math”
 - “Why do I need chemistry? I just want to grow plants.”
- Put the students in the lab
- Let them work on the topics they came back to school to learn
- Give them enough rope to hang themselves



Important: F does not mean “failure”, it means you aren’t ready for the next class.

Stealth STEM

2nd Semester



- Continuing students
 - “Dr. Gómez, the chemistry class is full. What do I do?”
- Students who “discover” they need STEM courses do much better than students who are “told” they need STEM courses
- Paid internships are the best retention tool
 - “You mean I can get *PAID* to do this?”



BA

Sustainability Studies



AAS

Course	Prerequisite
SUS 300, Foundations of Sustainability	College composition and reading
SUS 325, Energy Systems and Sustainability	SUS 300 or 301; C- or better
SUS 340, Environmental Chemistry	CHE 112; C- or better
SUS 341, Sustainable Agriculture	College composition and reading; SUS 300 or 301
SUS 440, Watershed Science and Land Use Impacts	SUS 300 or 301; C- or better
SUS 350, Permaculture Design I	AS/BS degree ,or junior standing ,or permission
SUS 351, Permaculture Design II	SUS 350, C- or better

Course	Prerequisite
ENVR 111 Introduction to Sustainability	NONE
ENVR 112 Introduction to Sustainable Technologies	NONE
WATR 160 Applied Chemistry for Water Operators	NONE
GRHS 121 Greenhouse Operation and Management	NONE
WATR 216 Watershed Management	NONE
GRHS 123 Introduction to Hydroponic Systems	NONE
GRHS 127 Hydroponic Vegetable Production	GRHS 121, 123, 125

- In order to be fully admitted to the Sustainability Studies program at CMC, you are required to earn an Associate of Arts, Associate of General Studies, or Associate of Science degree and begin in your junior year.
- At SFCC you sign up as a freshman.

Controlled Environment Agriculture

Islandable 12,000 ft² Greenhouse

- Not Islandable for heating
- 90% less water use
- Winter Night Heating
- Stored biogas winter heat

Aquaponics

Hydroponics

Algae Cultivation

Student and Commercial Training

Resiliency:

- Operational during Covid-19 Public Health Emergency
- Provided over 10 tons of fresh produce to local food banks



Controlled Environment Agriculture/Culinary Arts

50,000 Free Nutritious Meals
to Santa Fe County's most
vulnerable





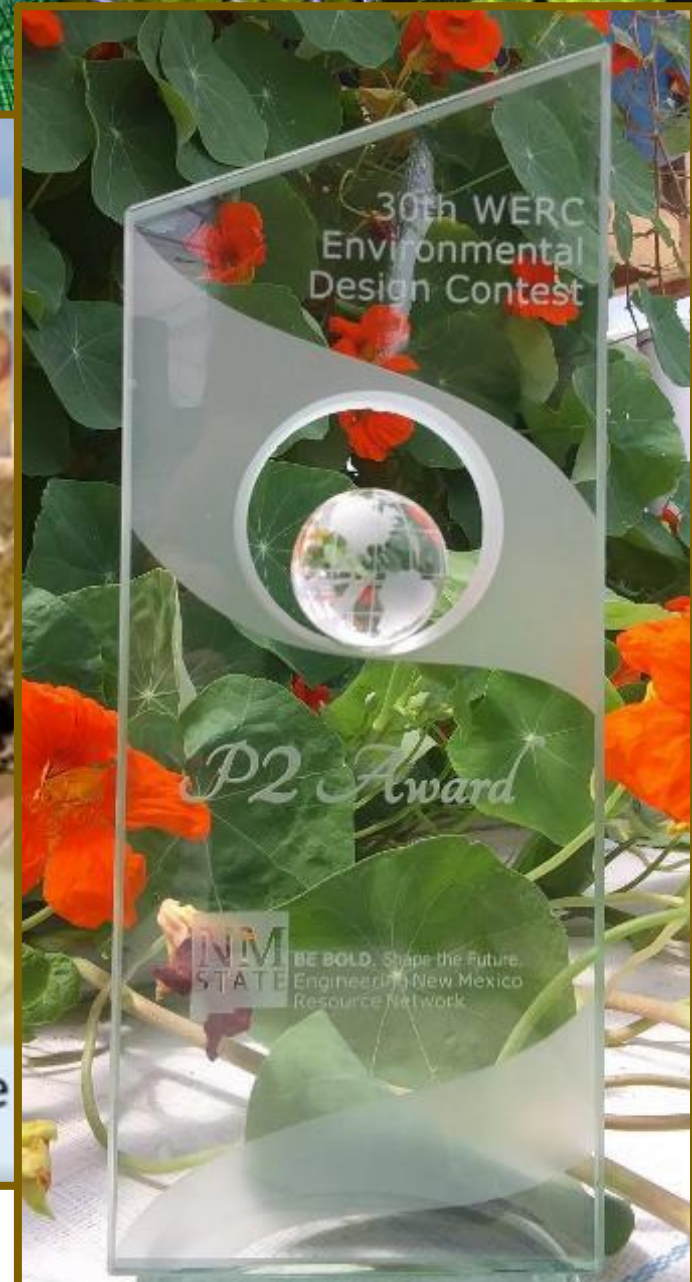
*Community College
Biotechnology Degree
ACC*

*Algae Cultivation
Extension Short-Courses*

*Community College
Farming Degree
SFCC*



Algae Cultivation



ATEC Algae Cultivation Certificate Program Curriculum Review, 2018



The Curriculum Review Committee consists of academic and industrial members of the ATEC Advisory Committee:

- Anne Jakle: University of New Mexico
- Charles O’Kelly: Cyanotech, Inc.
- Philip Pienkos: NREL
- Sarah Smith: J. Craig Venter Institute
- Rebecca White: Qualitas Health, Inc.

2017 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

#3 of 277 projects

2019 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

#1 of 450 projects

2021 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

**#1 of 47 Advanced
Algae Projects**

Algae Cultivation Badges offered at SFCC

Introduction to Algae Cultivation



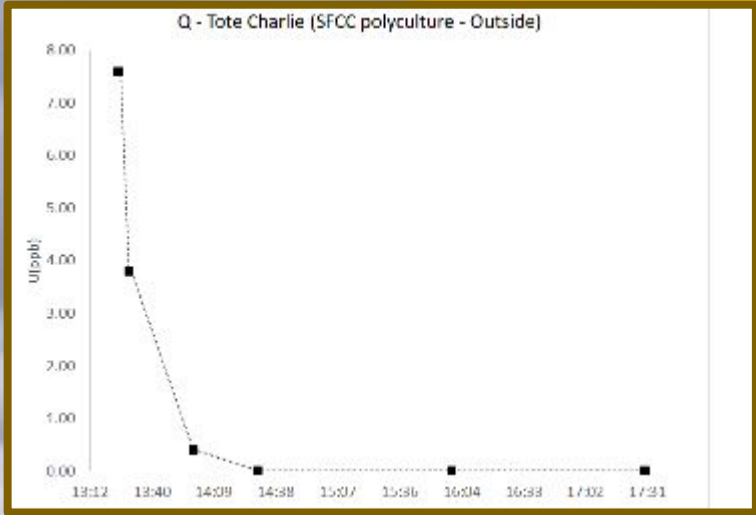
Advanced Algae Cultivation



Algae Harvesting



Algae Cultivation



AMBROSIA LAKE, NEW MEXICO
URANIUM MILL TAILINGS REPOSITORY

NO TRESPASSING
THE U.S. DEPARTMENT



Welding

Frank Trujillo – 2nd place SkillsUSA



Collateral Education



World's highest altitude oyster farm
Real... "Rocky Mountain Oysters"



One of these

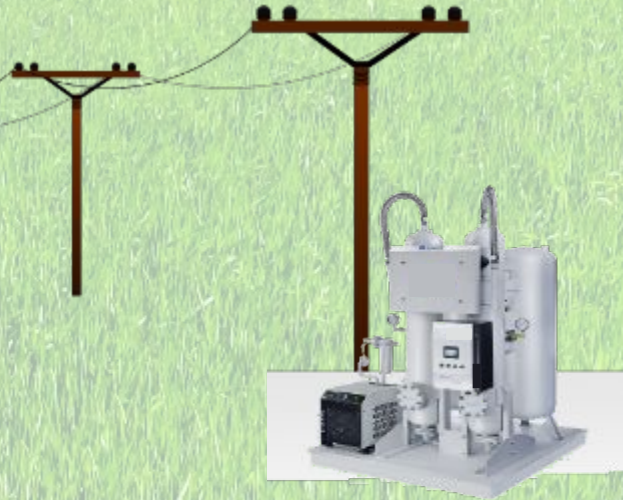
four of these full
of oysters

Perhaps soon the world's highest
Gracilaria seaweed farms

Summer



Solar overgeneration in summer



Pressure swing adsorption



Methane storage

85-95% CH₄

Carbon-free heat

Winter



Or ALGAE!

40-55% CH₄

Biogas
Wastewater
Food waste
Greenhouse waste

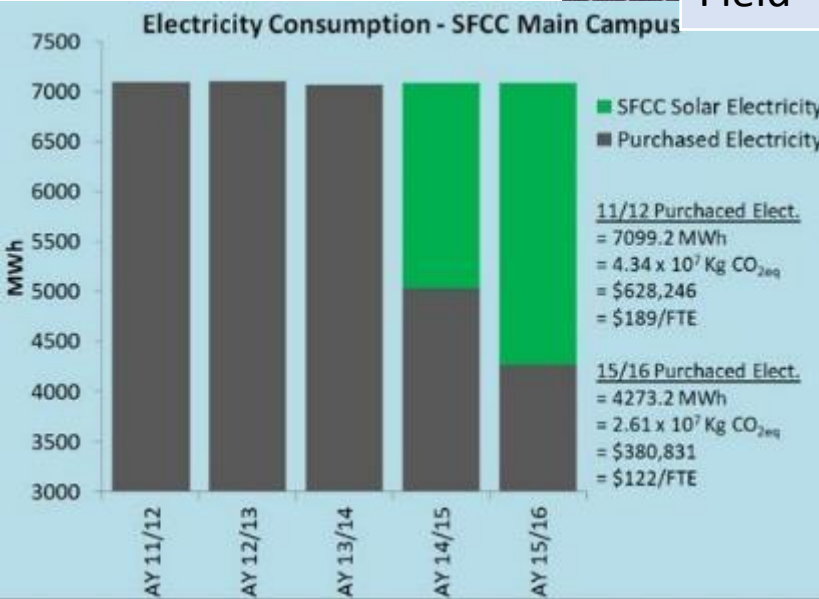


Empower Students, Strengthen Community.

Empoderar a los Estudiantes, Fortalecer a la Comunidad.

Inputs to produce 60,000 kg of tomatoes per year

	Water (Liters)	Area (hectares)	Energy (kWh)
Aquaponic Greenhouse	860,000	0.1	120,000
Field	17,100,000	1.4	17,000



- All of the programs in this talk would not have been possible or would be greatly reduced in scope if SFCC hadn't become mostly energy self-sufficient.
- Once SFCC is Energy self-sufficient the potential for growth is tremendous!



Pall Corporation

Ingenuity for life



Reunity Resources

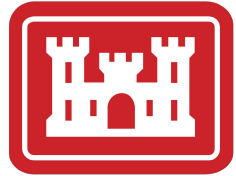
PEBBLELABS



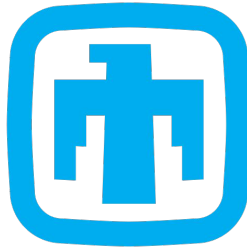
ALL POWER LABS



ALGAE WORLD NEWS



**US Army Corps
of Engineers.**

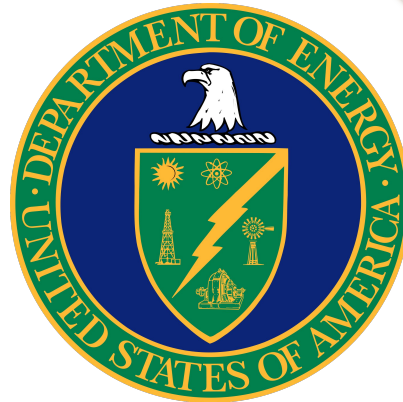


**Sandia
National
Laboratories**

**Pacific Northwest
NATIONAL LABORATORY**



Buckman Direct Diversion



Energy, Minerals and Natural Resources Department

*"It is not what we have that will make us a
great nation; it is the way in which we use it."
- Theodore Roosevelt*



**Welcome to the
LAB OF
ENCHANTMENT**

