



SFCC's Path to Net Zero

Stephen Gómez, PhD

*Chair, Advanced Technologies and
Sustainability*

**SUSTAINABLE
TECHNOLOGIES**

SFCC is a Hispanic Serving Institution (HSI) and Minority Serving Institution (MSI)



Anglo – 43.5%

Hispanic – 45%

African Amer. – 1%

Asian/PI – 2%

Native Amer. – 8.5%

Male – 38%

Female – 62%



Empower Students, Strengthen Community.
Empoderar los Estudiantes, Fortalecer la Comunidad.



ENERGY EFFICIENCY



SOLAR ENERGY



GREEN BUILDING

BIOFUELS

WELDING

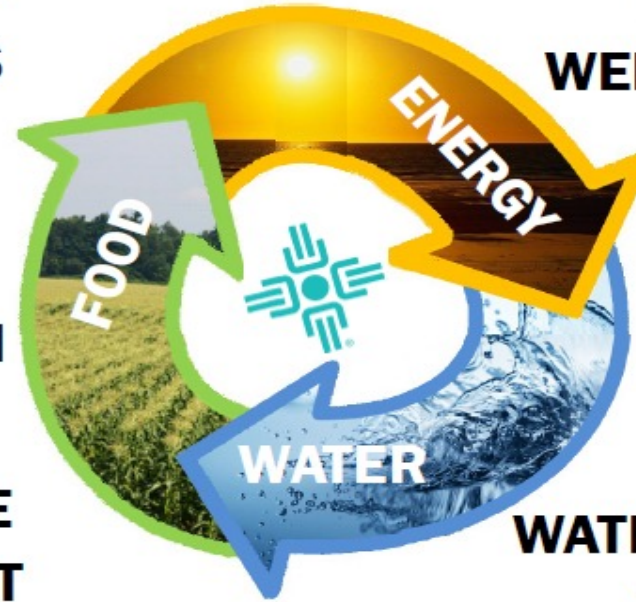
BIOMASS ENERGY

BIOGAS

PLUMBING



ALGAE CULTIVATION



WATER CONSERVATION

GREENHOUSE MANAGEMENT

WATER/WASTEWATER OPERATIONS

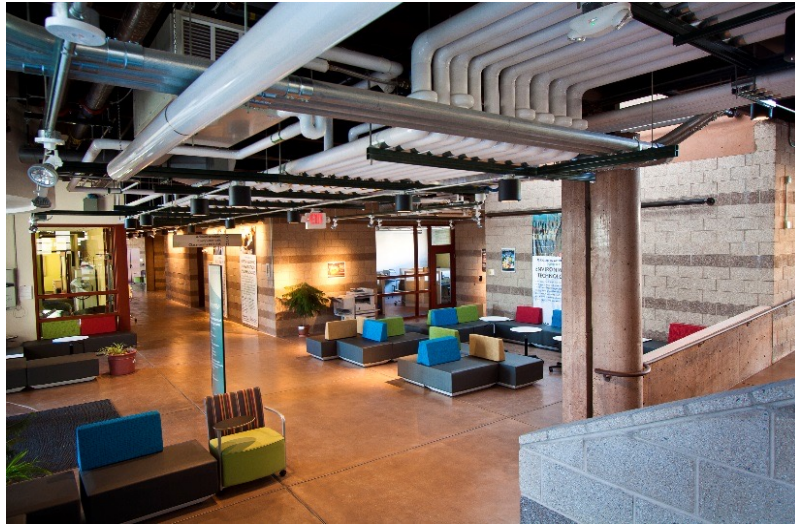


AQUAPONICS



Trades and Advanced Technologies Center

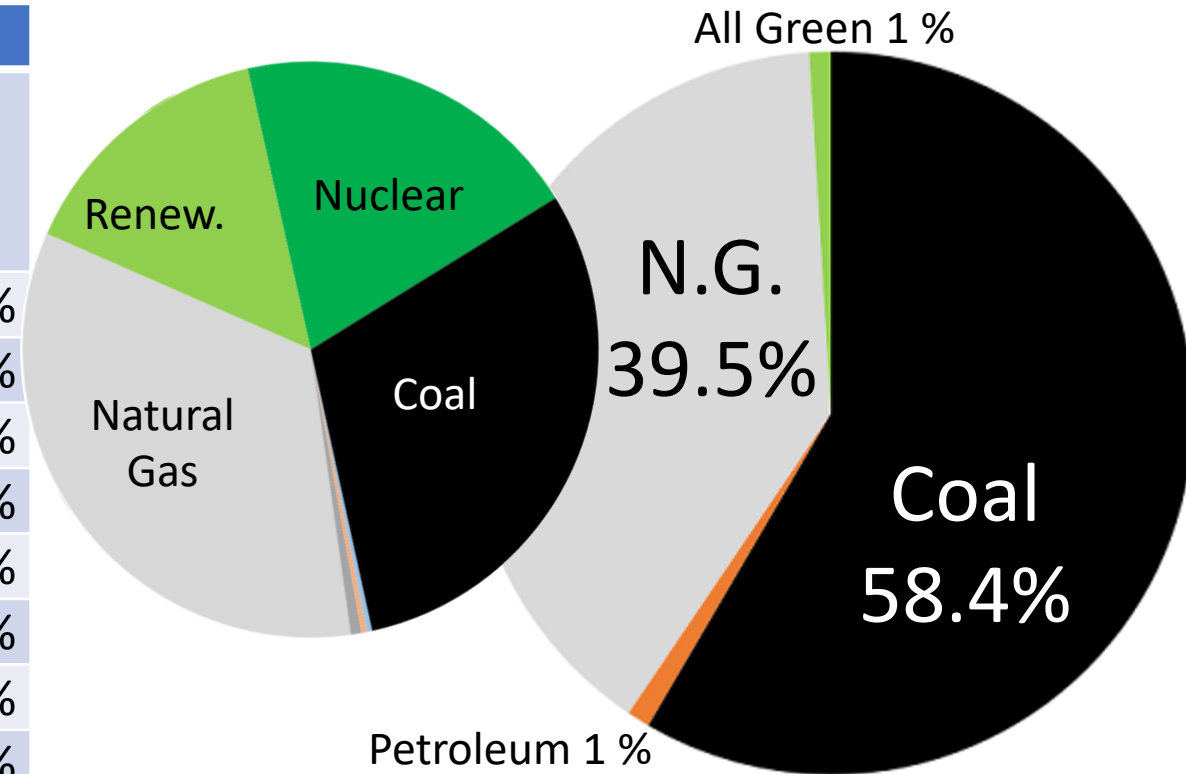
- U.S Green Building Council LEED®Platinum
- 42,000 ft² “living laboratory”
- Motion-sensing lights with 96% LED lighting
- Skylights with fiber optic tubes to distribute sunlight in the building
- Rainwater catchment for lavatory and greenhouse wet-wall use
- Grey water recycling for irrigation use
- Building envelope with R-Value of 30



U.S. electricity carbon footprint by energy source 2016

Carbon Footprint (cradle to grave) IPCC-2011

Energy Source	g CO ₂ /kWh	% of Electric Generation CO ₂
Coal	1001	58.4229%
Petroleum	893	1.0287%
Natural Gas	751	24.3670%
Natural Gas (combined cycle)	469	15.2172%
Solar - photovoltaic	106	0.0916%
Geothermal (open loop)	45	0.0173%
Solar - concentrated solar	22	0.0190%
Biomass	18	0.0518%
Ocean	17	0.0000%
Nuclear	16	0.6051%
Wind	12	0.1290%
Hydro	4	0.0499%
Geothermal (closed loop)	1	0.0004%



- In 2016 the US produced 2135.5 Tg of CO₂ from generating electricity
- 20.6 Tg came from all Green fuels combined

Example projects/homeworks

SUST 1130 Carbon Footprint

Name: _____
100 pts

Conversions to remember:

- 1 kWh of electricity from coal = 1 kg CO₂ = 2.2 lbs CO₂
- 1 kWh of electricity from natural gas = 0.5 kg CO₂ = 1.2 lbs CO₂
- 1 kWh of electricity from solar = 0.105 kg CO₂ = 3.7 ounces CO₂
- 1 kWh of electricity from geothermal = 0.045 kg CO₂ = 1.6 ounces CO₂
- 1 kWh of electricity from nuclear = 0.016 kg CO₂ = 0.6 ounces CO₂
- 1 kWh of electricity from wind = 0.012 kg CO₂ = 0.4 ounces CO₂
- 1 gallon of gasoline = 8.7 kg CO₂ = 19 lbs CO₂
- 1 kilogram = 2.2 pounds
- 16 ounces = 1 lb
- 1 gallon = 3.785 liters

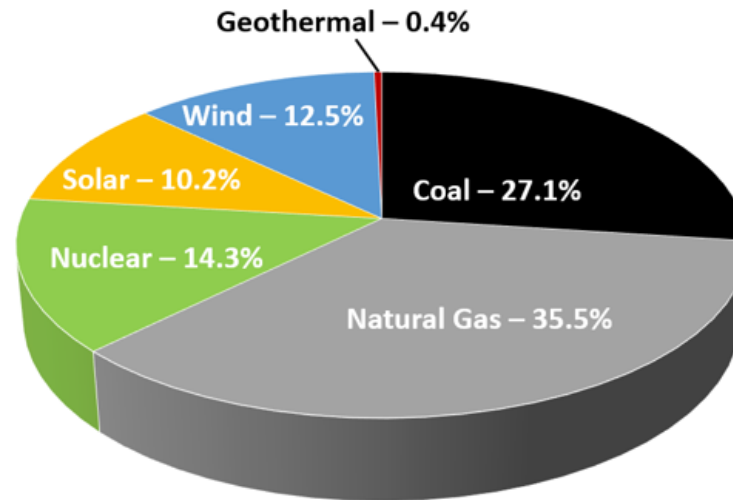
Electricity

PNM's Electricity Generation Portfolio
(Dec 31, 2020) is to the right.

Fuel economy (for your car)

<http://www.fueleconomy.gov/feg/make.shtml>

(use combined city/highway value)



Energy Factoid

Manure from 1200 cows = 1 MW electricity from biogas.

According to the USDA-ARS there are 98,400,000 cows in the US.

How much electricity potential is in American cow pies is left as an exercise for the student.



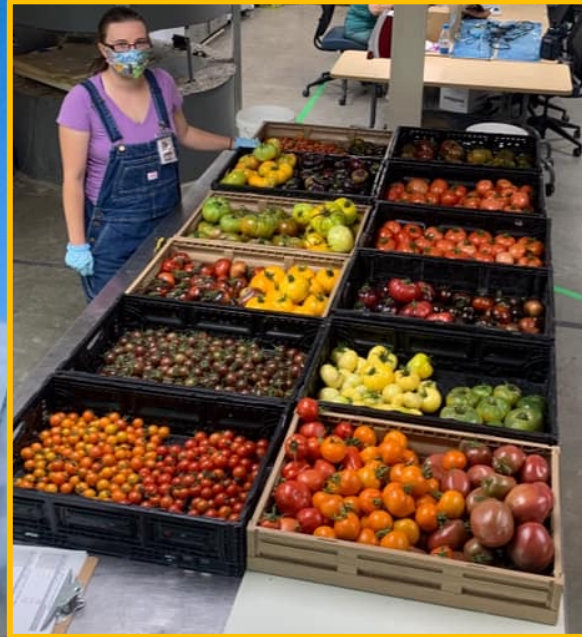
In the last 20 years 31,000,000 acres of farmland have grown houses

8 Million
Pound Gorilla



In the next 50-60 years humans will need to grow as much food as has been grown since agriculture began in the Neolithic

12,000 ft² Commercial Greenhouse Educational Microgrid



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

During the 1st 6 months of the pandemic

- CEA faculty and students provided 10 tons of fresh produce to local food banks
- Culinary faculty and students with WCK prepared 60,000 free meals

Green Trades



SFCC's Welding program is powered by the sun



Buckman Direct Diversion – Santa Fe
1.5 MW solar to pump water 11 miles uphill
from river to treatment plant (30% of energy)



ABCWUA Southside WWTP - Albuquerque
4.5 MW (55Mgal/day) – 1.3 MW Solar, 1.2 MW Biogas



Algae Cultivation



Memorandum of Understanding
Between
Los Alamos National Laboratory
and
Santa Fe Community College



2017 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

#3 of 39 Advanced Algae System projects

2019 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

#1 of 36 Advanced Algae System projects

2021 PROJECT PEER REVIEW

U.S. DEPARTMENT OF ENERGY
BIOENERGY TECHNOLOGIES OFFICE

#1 of 47 Advanced Algae System projects



AlgaePrize
NextGen Algal Innovators

3 of 15 finalist teams are from SFCC

- Phytoremediation of Uranium mine waste
- Food production with brackish ground water
- Water treatment of hydroponics effluent

To grow 1 kg of algae requires 1.8-2.7 kg CO₂
And produces 1.0-1.8 kg O₂

Value-added products: protein, lipid,
carbohydrate, pigments, clean water...





Newest Program Distributed Energy Technology and Systems

Soon
Building Automation Systems



Technical Education in Energy Storage Technologies

US DOL predicts ~14,000 new jobs for electrical power-line installers and repairers by 2024

This projection does not include the “smart” jobs for the new grid



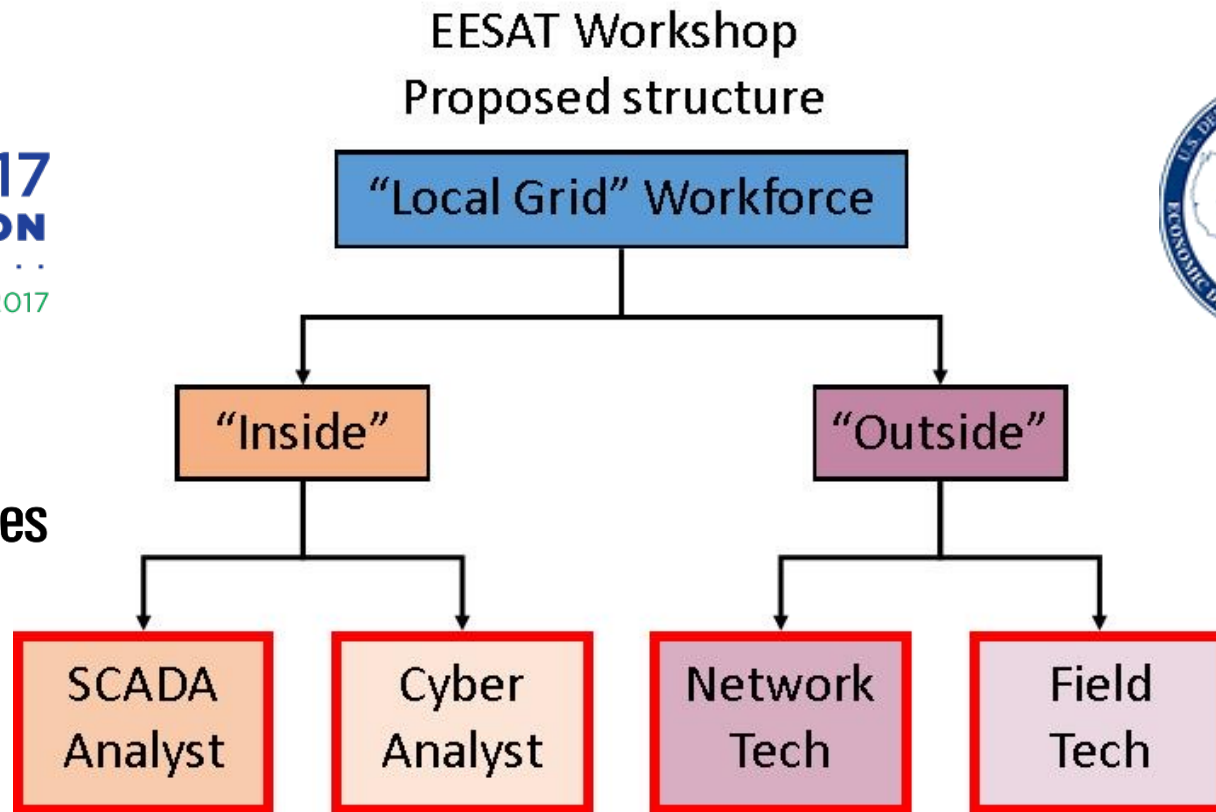
PEER REVIEW 2017
EVOLUTION & REVOLUTION
San Diego, California | October 9-10, 2017



Sandia
National
Laboratories



SIEMENS
Ingenuity for life



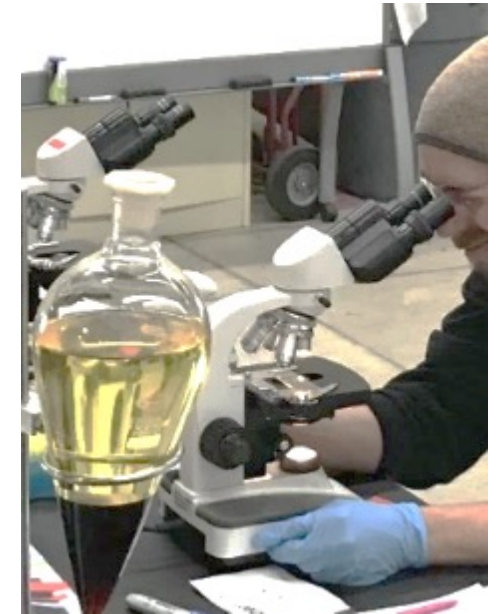


- All of the programs in this talk would not have been possible or would be greatly reduced in scope if SFCC hadn't become more energy self-sufficient.
- Once SFCC is campus microgrid is finished the potential for growth is tremendous!

Microcredential development at SFCC

Algae Cultivation- Badges

1. Identify the micro skill set groupings for digital badge delivery
2. Industry survey of need for the skill sets represented in the credit course.
3. ABO Endorsement
4. Use of SFCC Continuing Education Department for delivery through Credly
5. Algae Cultivation *Digital Badges*:
The micro badges can be combined into a macro badge and applied to credit offerings at SFCC



Intro to Algae Cultivation
Lab Practicum test and
Digital Badge Assessment.
Dec. 2019

Microcredentials are a quick way for employers to determine if a potential employee actually has the skills the employer is looking for.



Algae Cultivation Basic Measurements and Safety

Last updated 29 Aug 2019

Details Insights History

Earners of the Algae Cultivation Basic Lab Safety badge will demonstrate basic lab safety, basic equipment operations, calibration and measurements. Laboratory Safety includes use and proper choice of PPE, SDS, (and low level) Hazardous Waste classification handling and disposal. Basic instrumentation includes: Calibration and measurements for pH, salinity, conductivity, temperature, PAR, DO and Pipetting; Chem Hood and Autoclave operations

ISSUED BY Santa Fe Community College
CREATED 25 Apr 2019

- SKILLS
- Algae
 - Aquaculture
 - Aquaculturists
 - Aquarists
 - Aquatic Technology
 - Autoclave
 - Blue Green Algae
 - Chemical Hood
 - Conductivity
 - Cyanobacteria
 - Dissolved Oxygen
 - Lab Calibration
 - Lab Measurement
 - Lab Safety
 - Marine Technicians
 - Photosynthetically Active Radiation
 - Phycology
 - Pipetting
 - Salinity
 - Temperature
 - pH

WHAT IT TAKES TO EARN THIS BADGE

- Prerequisite: Complete the Introduction to Algae Cultivation online course, SFCC: ALTf 161.
- Demonstrate competency in proper lab etiquette and safety for algae cultivation.
- Demonstrate competency in calibration and measurements for pH salinity, conductivity, temperature, PAR, and DO in a lab setting.
- Demonstrate competency in pipetting in a lab setting.
- Demonstrate competency in Chemical hood and autoclave operations in a lab setting.

[View Additional Information >](#)



• Badge image

• Course description

• Issuer:

→ Link to other badges offered by SFCC

• Skills learned/assessed

→ Link to current job listings

• Assessment requirements

→ Link to SFCC Algae Program:

<https://www.sfcc.edu/programs/algae/>

• Additional links:

<http://algae.foundationatec.org/>



*"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**

