

Sustainable Schools Program and Practice: Partnership Building with the Tempe Union High School District



Auriane Koster, PhD candidate, ASU School of Sustainability

Overview

- About Our Program
- Tempe Union High School District
- Tempe High School
- Lessons Learned

About our Program

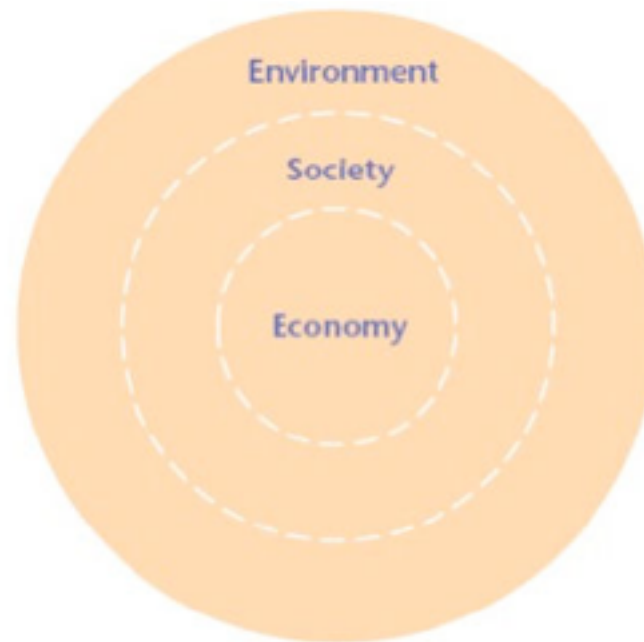


<http://sustainableschools.asu.edu/>

What is Sustainability?

“Meets the needs of the present without compromising the ability of future generations to meet their own needs.”

– UN Brundtland Report (1987)



The Sustainability Science for Sustainable Schools program matches ten ASU graduate fellows per year with teams of teachers and school leaders to address sustainable school challenges across the scales of curriculum, campus and community.

ASU's Sustainable Schools Program

A project funded by the



National Science Foundation
WHERE DISCOVERIES BEGIN

- National GK-12 Program
- Focus on STEM
- 5 year program awarded to ASU-GIOS in 2009
- Emphasis on Community Partnerships
- Focus on High Schools

Senior Leadership Team

➔ Principal Investigators and Project Coordinator

Indicator Expert Team

➔ Researchers as Thematic Experts and Advisors

Graduate Fellows

➔ Master and PhD Students

What makes us unique

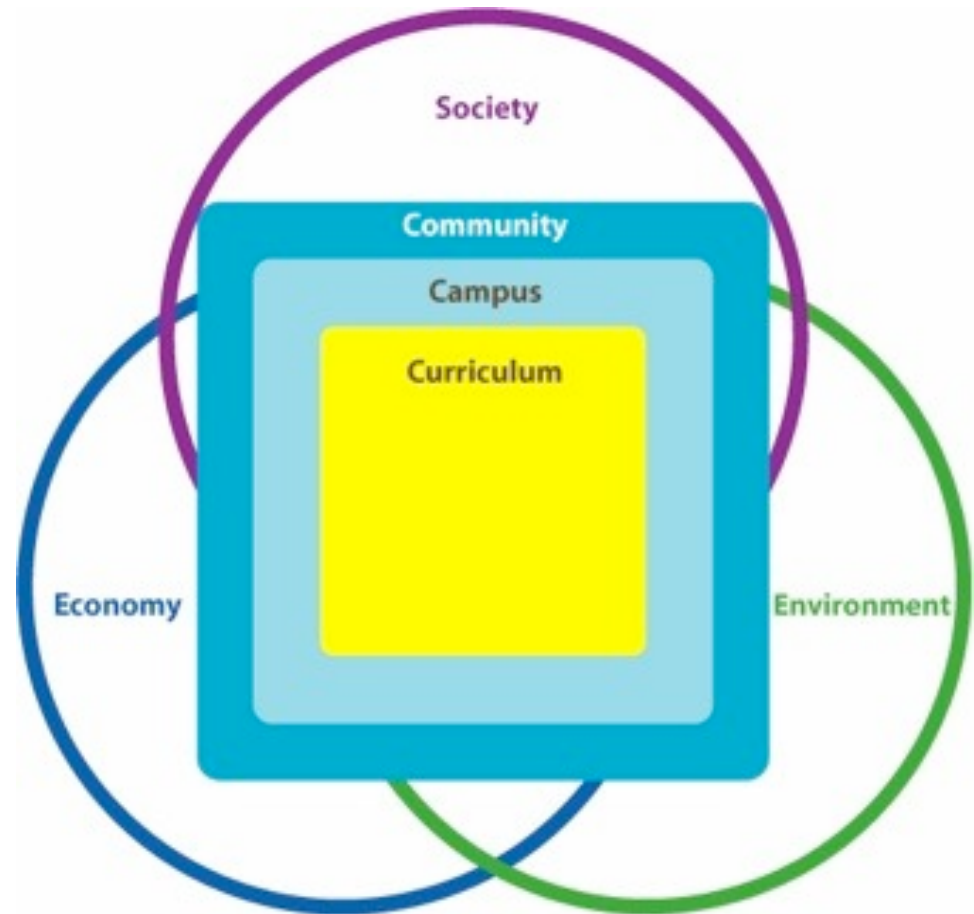
- Conceptual Focus
 - Sustainability Science
 - Emphasis on scientific methods/inquiry state standards
- Unique Characteristics
 - Project-based and inquiry-based learning
 - Emphasis on community partnerships
 - Focus on high schools

Framework: Three C's

Curriculum: Teaching and Learning

Campus: Infrastructure, Administration, Human Resources

Community: Parents, Businesses, Government, Non-profits, Neighborhoods



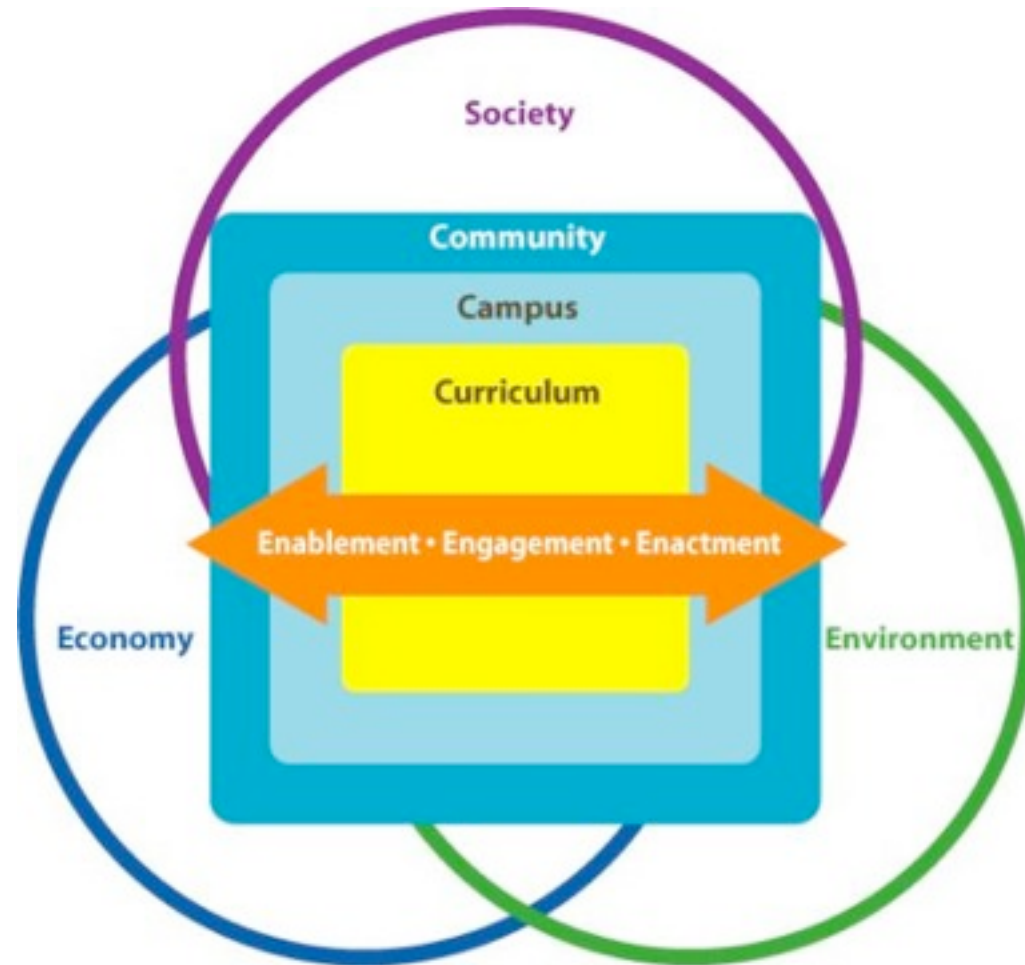
UK Department for Children, Schools and Families / Department for Education and Skills (UK-DCSF). (2008). **S3: Sustainable School Self-Evaluation for primary, middle and secondary schools**. July 2008 Manual. PDF retrieved Aug. 17, 2009 from www.teachernet.gov.uk/sustainableschools

Framework: Three E's

Engagement: Academic study and analysis

Enablement: Values and attitudes

Enactment: Project and system implementation



The program goals are to:

- **INCREASE** integration of sustainability and interdisciplinarity in curriculum and instructional development
- **ENHANCE** fellows' graduate experience and career trajectories
- **IMPROVE** graduate students' communication and teaching skills
- **EXPAND** university outreach and relationships with high schools

Goal #1:

Increase integration of sustainability concepts into high school curriculum

Within the last two years, **46 lessons** have been taught to **179 classes** touching over **5,762 students**, and **68 sustainability projects** have been accomplished across **10 school sites**.



BioScience High School Hybrid Car Project



Carl Hayden HS Planter Box Project

sustainability science for sustainable schools
NSF-Funded GK-12 Project

Spaceship Activity

Design a 6,000 year spaceship trip carrying everyone that you care about, and bringing your descendants back to Earth safe and happy.

- Propulsion and construction are already taken care of.
- What life support systems (oxygen, food, water, energy and waste) would you take?
- What social systems (governance, recreation and entertainment) would you use?
- The ship can be as large as you want.
- Sunlight is the only input
- Heat is the only output.
- Use only existing technology.

A small illustration showing a spaceship in space and a group of people inside a futuristic, brightly lit interior.

ASU GLOBAL INSTITUTE of SUSTAINABILITY
ARIZONA STATE UNIVERSITY

Goal #1:

Increase integration of sustainability concepts into high school curriculum

Tempe High School has also piloted a new year-long introduction to sustainability course, our on-line teacher's course has been piloted and our new **Toolkit for Teaching** has been posted on our website.

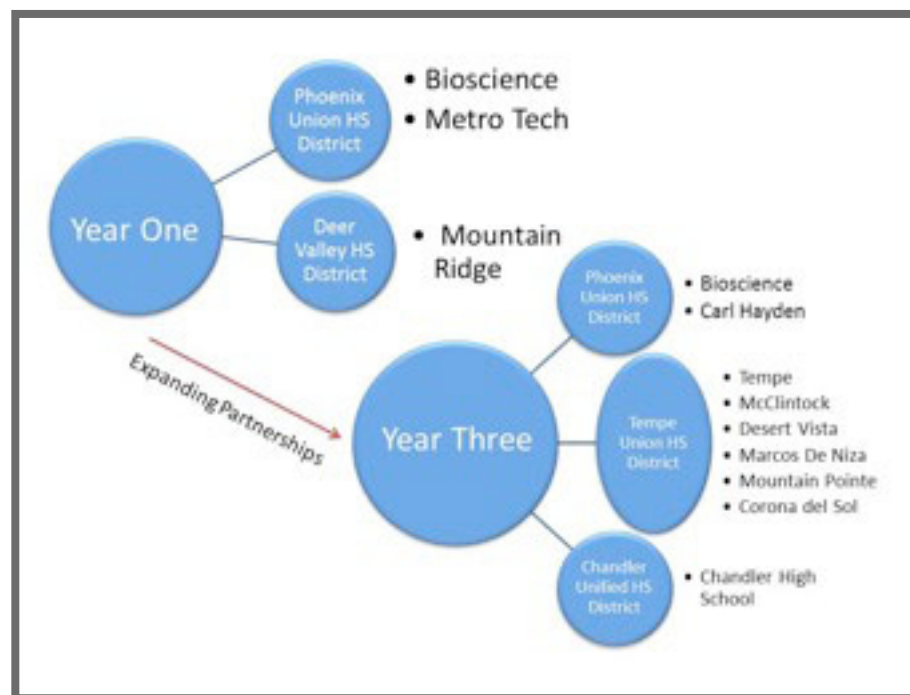


Core Sustainability Areas of Study	Subject Area	Classroom Project	Classroom Activity	Example Reading or related key concept
Food System	Nutrition	Calculating food miles for a sandwich	Farm to Table Lesson	"Omnivore's Dilemma"
Energy System	Renewable and nonrenewable energy sources	Creating a camp energy portfolio	Research sustainability impacts of different sources	Urban Planning
Water System	Water Cycle Unit	Determine how much water your school uses	Research non-point versus point pollution	Water conservation in the desert
Outdoor Ecosystem (Landscape)	Math Unit: Collection, display & analysis of data	Do a campus grounds audit (two months)	Research costs – benefits of different types of plants	"Landscape watering by the numbers"

Goal #2:

Expand university outreach with local high schools

We have expanded our partners **from 3 schools in two districts in year one**, to **9 schools in three districts in year 3**, with significantly more growth and positive impacts expected in the next three years.



Goal #2: *Expand university outreach with local high schools*

In year three, our outreach fellows co-hosted the local CEFPI symposium in February 2012 called “What’s Next for Sustainable Schools and Communities?”, and an article was published on our program in the journal, *School Planning and Management*.



Auriane Koster, Outreach Fellow, presents at the February 2012 local CEFPI Symposium held at Arizona State University.



Featured article in *School Planning and Management*

Goal #3:

Enhance graduate fellows' experience and career trajectories

Our program has **supported 20 graduate MA and PhD fellows** over the last three years, with 7 Fellows returning for a second year of service.



Fellows present poster at March 2012 GK-12 conference in Washington D.C.

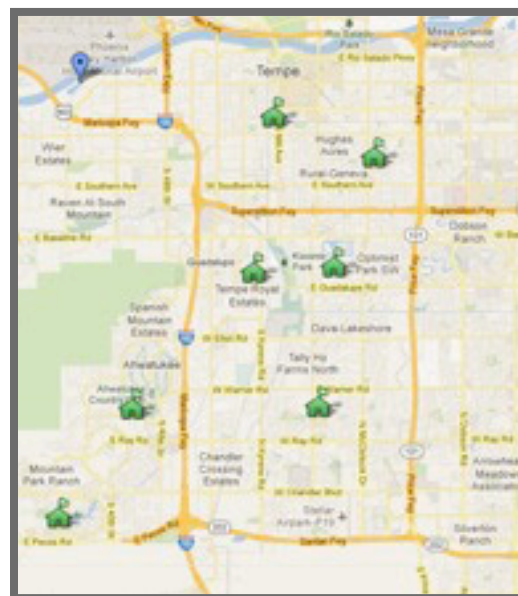


Erin Frisk presents at 2010 NSTA Conference

Goal #4:

Improve graduate student's communication and teaching skills

We have focused on placing our Fellows in school settings that support sustainability through delivery of curriculum and special sustainability projects.



We now participate in all 7 schools within the Tempe Union High School District.

Goal #4:

The TUHSD Summer 2012 Sustainability Workshop

Our Tempe Fellows assisted in facilitating teacher discussions about incorporating sustainability into their schools during two summer teacher workshops hosted by the Tempe Union High School District and partners.



Interactive session on Day 2



Solar power hot dog cooker for lunch



A lighting lab break-out session

Question

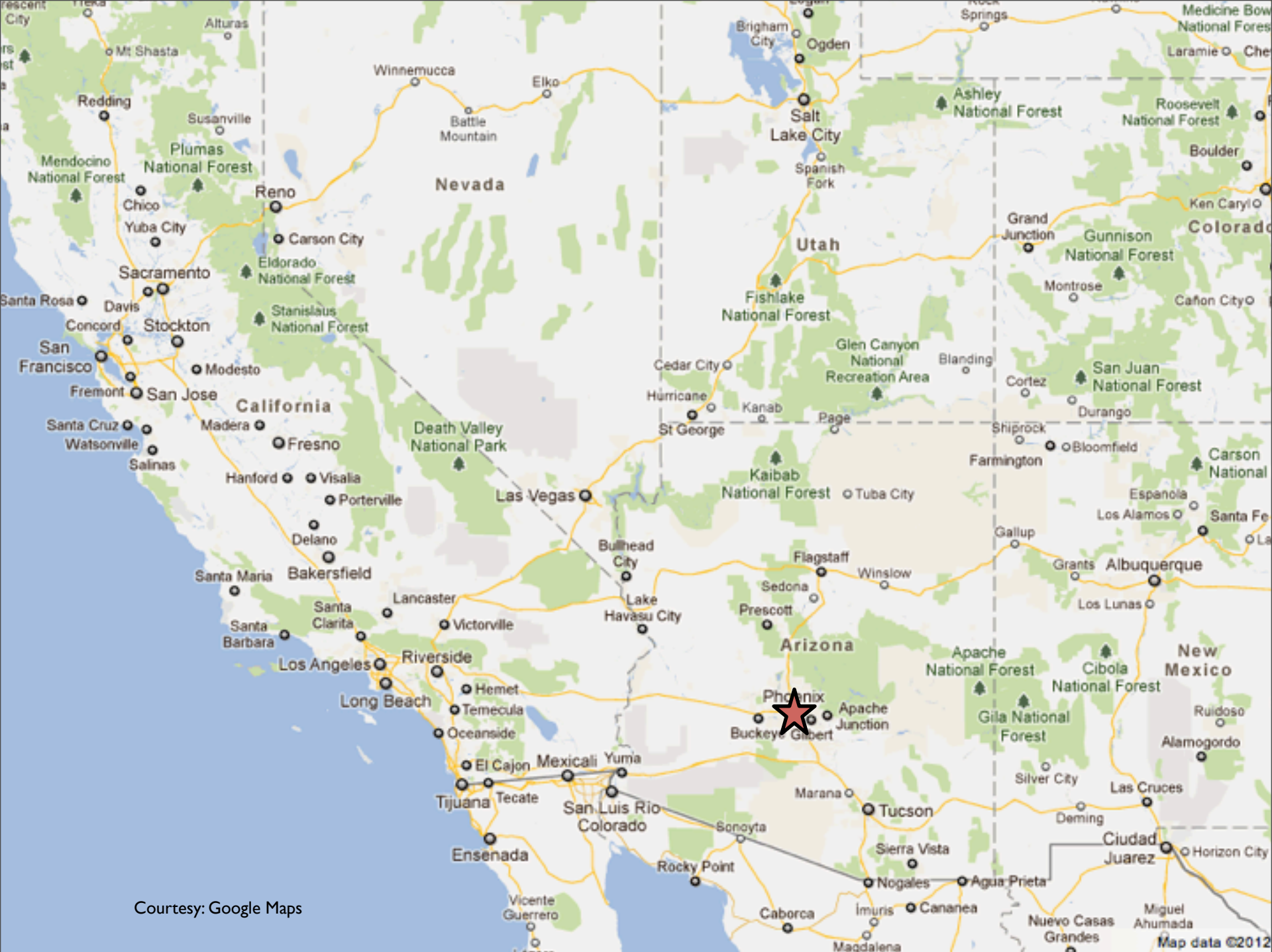
- **How do you see sustainability already incorporated in the buildings that you have worked on/in?**

Tempe Union High School District (TUHSD)



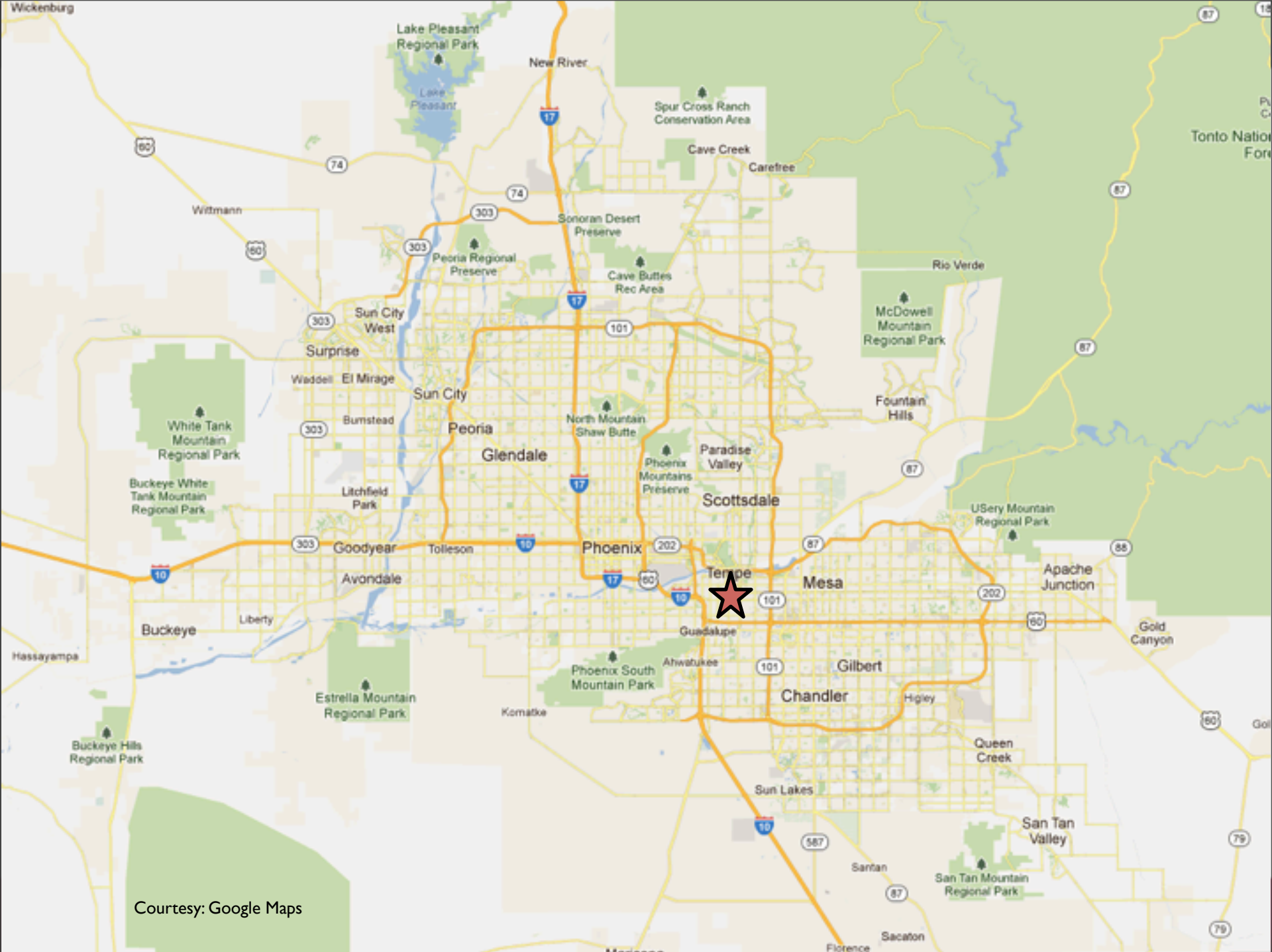
“Innovative Energy Solutions and Sustainability Project”

Working to make Tempe Union District schools more sustainable



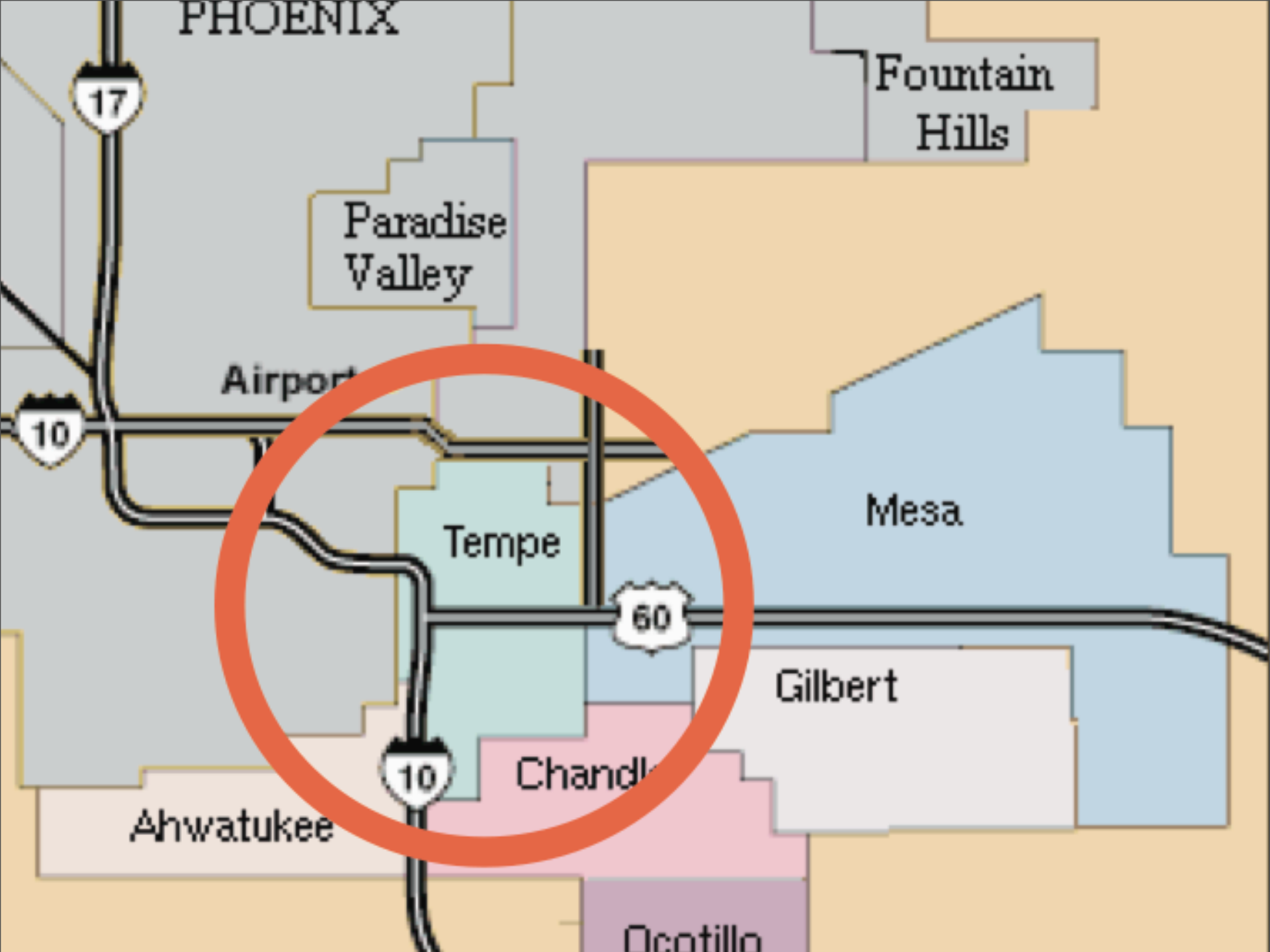
Courtesy: Google Maps

Wednesday, August 22, 2012



Courtesy: Google Maps

Wednesday, August 22, 2012



TUHSD Overview

- Established April 4, 1908
 - Tempe Union High School
- 7 High Schools
- 91% four-year graduation rate
- Open Enrollment

“Through our goals and objectives, we will transform the structure of our schools to meet the needs of the ever-changing world.”

TUHSD Schools

School Name	Enrollment	Year Established
Tempe High School	1,522	1908
McClintock High School	1,940	1965
Marcos de Niza High School	1,896	1971
Corona del Sol High School	2,482	1977
Mountain Pointe High School	2,694	1991
Desert Vista High School	3,003	1996
Compadre High School	737	1997
TOTAL	14,274	

Student Demographics

Caucasian	49%
Hispanic	27%
African American	12%
Asian	7%
Native American	5%

Employee Demographics

Teachers	710
Support Staff	569
Administrators	44
TOTAL	1,323

Sustainability and TUHSD

- Educational Partners:
 - Arizona State University (ASU)
 - Global Institute of Sustainability
 - School of Sustainability
 - GK-12 Program
 - Rio Salado Community College
- Business Partners:
 - Intel
 - Salt River Project (SRP)
 - Arizona Public Service (APS)
 - Southwest Gas
- Government Partners:
 - City of Tempe

Sustainability and TUHSD

- Go Green Initiative
 - Innovative Energy Solutions & Sustainability Project
- Purpose:
 - Integrate environmental and sustainability education across the district
 - Create cutting-edge and unique programs, making TUHSD a leader
 - Link classroom learning to co-curricular programs, campus operations and civic engagement opportunities

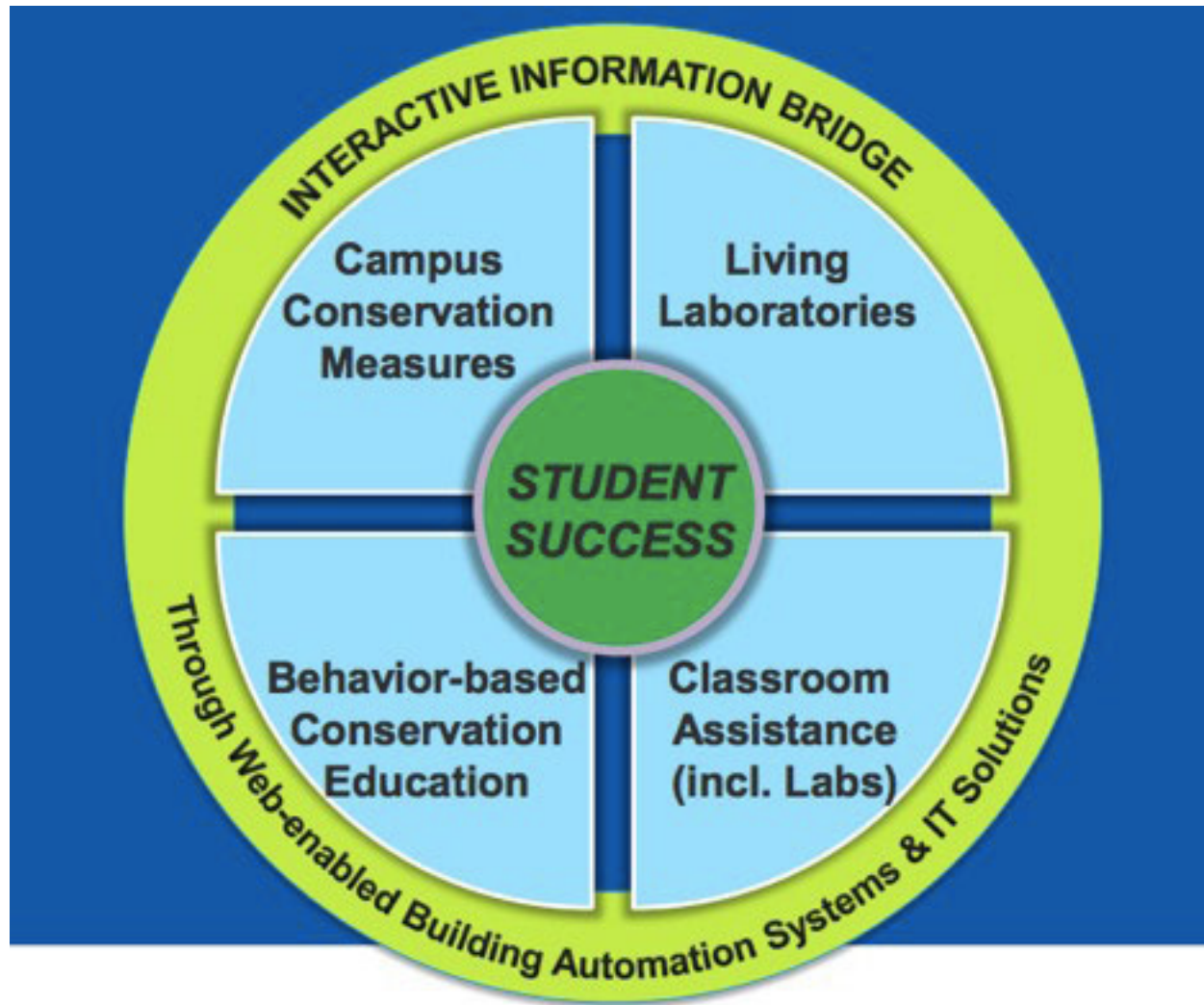
TUHSD Go Green Plan

- Phase I (*underway with Chevron*)
 - Energy Audits
 - Feasibility Studies
 - Financial and Payback Studies
 - Resources and data for sustainability education & project management
 - Campus Energy Projects
- Phase II
 - Procurement of equipment and facility modifications from Phase I
- Phase III (*concurrent with Phases I & II*)
 - Develop Internal Government Agreement (IGA) with educational partners
 - Develop Curriculum

Chevron's Phase I Sustainability Education Strategic Plan Goals

1. Champion campus conservation measures
2. Build behavior-based conservation education
3. Install Living Laboratories
4. Provide classroom assistance for the labs and their yielded data

Conceptual Model



Phase I Projects

- Energy Conservation Measures
- Classroom Assistance and Telemetry
- Living Laboratories
 - Ready by 2012–2013 Academic Year

Energy Conservation Measures

- Lighting technologies
- Converting exterior lighting to digital control
- Cooling tower water meter
- Replacement or re-commissioning of building automation system
- Ductwork modifications/repairs
- Cleaning outside air louvers
- Direct Evaporative Supplemental Cooling
- Variable Volume Chilled water pumping
- Utilityvision
- Vending Machine controls
- Window Tinting
- Power Factor Correction

Classroom Assistance and Telemetry

- Dashboards
- Heat Pump Trainer at Desert Vista
- Envision Coach
- Envision Behavioral Initiative – “Go Green”
- Sustainability Education Strategic Plan
- Sustainability Longitudinal Impact Study

Living Labs

- Tempe High – Lighting Lab
- Compadre – Solar Electric Car Charging Station
- Mountain Pointe – Battery Energy Storage
- Corona del Sol – Fuel Cell
- Marcos de Niza – Gas Heat Pump
- McClintock – Solar Thermal System

ASU GK-12 & TUHSD Involvement Timeline

- 2010-2011 Academic Year
 - Two ASU GK-12 Fellows (Tempe High School)
- June 2011
 - TUHSD Teacher Sustainability Workshop
 - Entire GK-12 Program Participated
- 2011-2012 Academic Year
 - Phase I
 - Seven ASU GK-12 Fellows working with district at either full or part-time commitment in all schools

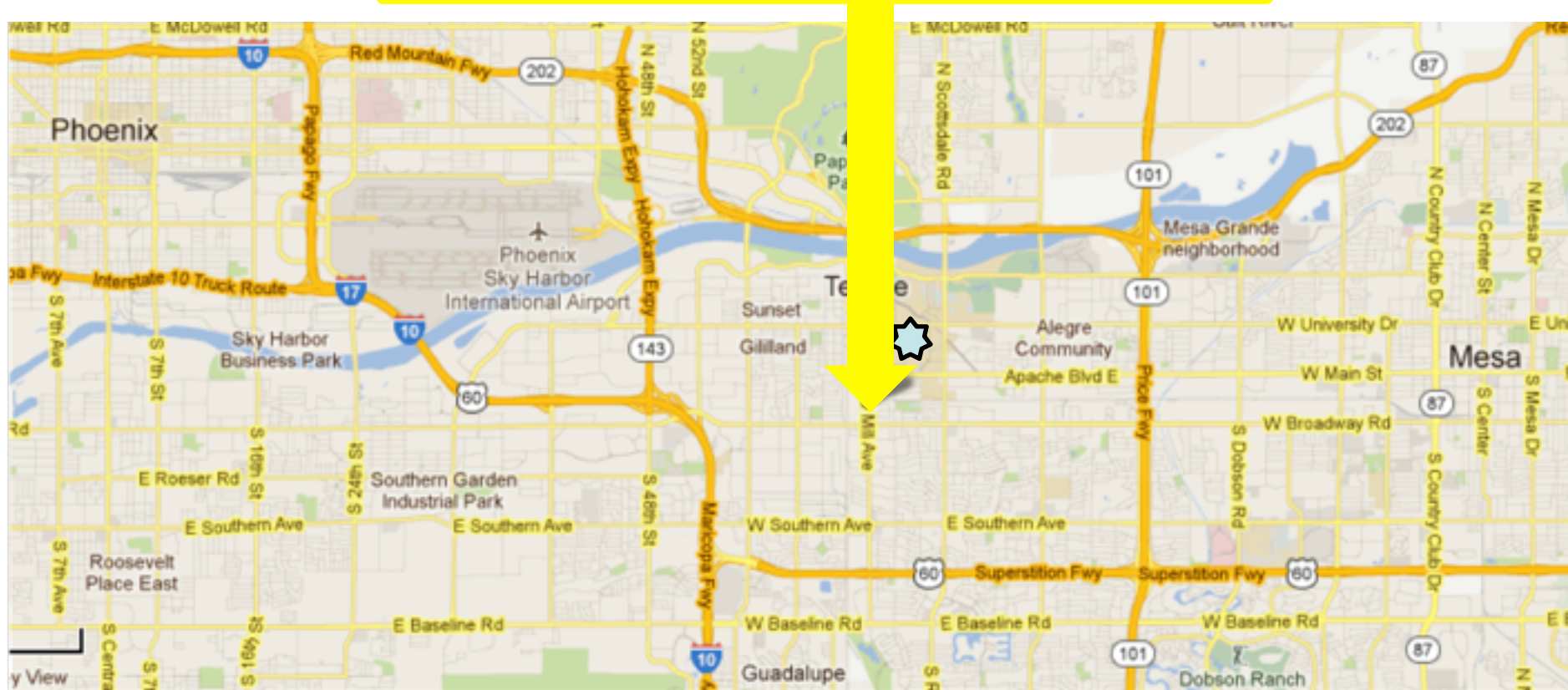
District Sustainability Surveys

- Developed by ASU GK-12 Fellow
- Track knowledge, behaviors, attitudes, barriers and participation in sustainability activities
- Two versions
 - Student
 - Teacher/Staff/Admin
- Rollout during Earth Week in April

Tempe High School (THS)



Tempe High School



Sustainability PLC

- Founded 2010–2011 academic year
 - 12 teachers in 7 departments
- Collaborative effort with ASU GK–12 Fellows
- Grassroots approach to sustainability education
- Aim to involve the wider community
- Teaching style:
 - Head (cognitive learning)
 - Hands (kinesthetic)
 - Heart (emotional attachment)



2010-2011
13 teachers
450 students

Lessons Taught

<i>Teacher</i>	<i>Subject</i>	<i>Fellow</i>	<i>Lesson</i>	<i>No. of Days</i>	<i>No. of Classes</i>	<i>Approx No. of Students</i>
Scott Madine	Government	-	I	?	4	100
Lorna Barker	Culinary Arts	Forrest	AI&E	4	3	75
Jessica Hauer	SpEd Living World	Forrest	E	5	2	24
Hauer + Nowicki	SpEd + Biology		I	4	2	50
Mary Bridget Nowicki	Biology					20
Steph Milam	Earth Science	Forrest	I	2	2	40
Tanya Moulton	Health		I		1	20
Lu Ann Kenner	SpEd		I			
Mike Warner	Math		I		4	80
Rosanne Stapka	English	Forrest	I	3	5	125
Aaron Jarvis	Physics	Forrest	AI&E	2	4	80
Priscilla Ketay	SpEd	Koster	I	5	2	10
Dale Cooper	Art		I		1	30
Gwen Reynolds	Biology	Forrest	I	2	1	20

I=Introduction, AI=Abbreviated Introduction, E=Sustainable Energy

Energy Conservation Poster Project

2010-
2011

Sustainability First at Tempe High
In August 2010, Tempe High students and staff partnered with APS and ASU School of Sustainability to create the Sustainability First at Tempe High initiative. This poster was created by 150 students to capture our efforts and share our understanding with community members. Tempe High School First on the scene being sustainable and green with sustainability.

Sustainability is...
Sustainability means meeting the needs of all people, the environment, and the economy now and in the future.

Sustainability principles...
Sustainability means meeting the needs of all people, the environment, and the economy now and in the future. It is a balance of three pillars: people, planet, and profit. We must all work together to create a sustainable future for ourselves and for the generations to come.

The Three Pillars...
Sustainability is a balance of three pillars: people, planet, and profit. We must all work together to create a sustainable future for ourselves and for the generations to come.

Meeting our Needs...
We must all work together to create a sustainable future for ourselves and for the generations to come.

Is it Sustainable?
We must all work together to create a sustainable future for ourselves and for the generations to come.

Jessica Hauer,
Stephanie Milam,
Nigel Forrest,
Auriane Koster

Alternative Energy Options

Energy is the foundation of everything we do. It is the power that makes our lives possible. We need energy to power our homes, schools, and businesses. But where does it come from? And how can we use it more sustainably?

SOLAR
Solar energy is a clean, renewable source of power. It can be used to power homes, schools, and businesses. Solar panels can be installed on roofs to capture the sun's energy and convert it into electricity.

WIND
Wind energy is a clean, renewable source of power. It can be used to power homes, schools, and businesses. Wind turbines can be installed in open areas to capture the wind's energy and convert it into electricity.

HYDRO
Hydro energy is a clean, renewable source of power. It can be used to power homes, schools, and businesses. Hydroelectric dams can be built in rivers to capture the water's energy and convert it into electricity.

GEOTHERMAL
Geothermal energy is a clean, renewable source of power. It can be used to power homes, schools, and businesses. Geothermal plants can be built in areas with hot underground water to capture the heat and convert it into electricity.

BIOFUELS
Biofuels are a clean, renewable source of power. They can be used to power homes, schools, and businesses. Biofuels are made from plants and other organic materials.

NUCLEAR
Nuclear energy is a clean, renewable source of power. It can be used to power homes, schools, and businesses. Nuclear plants can be built in areas with uranium to capture the energy and convert it into electricity.

LET'S DE-ENERGIZE!

Tempe High School... First on the scene being sustainable and green with sustainability. (Ms. Stogler's class)

Why?

- Energy is expensive! Use less and it saves us cash!
- Energy is limited! Save power for future kids.
- We waste a lot of energy! We can still do what we need using less.
- Energy from fossil fuels causes pollution! Use less for a healthier environment.
- Energy from fossil fuels causes global warming! Use less to help keep the planet cool.

At Home

- Lighting**
 - Turn off when not in use
 - Use CFL
- Water**
 - Take 1 minute showers
 - Use low flow faucets & shower heads
- Heating & Cooling**
 - Set thermostat to 72°F or above
 - Lower thermostat when not at home
 - Open windows & use fans
- Technology**
 - Unplug chargers
 - Shut down computers
 - Turn off TV, DVD player (use a power strip)
- Laundry**
 - Use Dry Cleaners
 - Put a lid on cooking pots
 - Turn off iron 1 minute before the end of time

On Campus

- Paper**
 - Reduce, Reuse, Recycle.
 - Do I need to print it?
 - Print double sided
 - Recycle it
- Classroom Equipment**
 - Computers, printers, projectors
 - Turn them off when not in use!
 - Stand powered power chargers
- Drinking Water**
 - Use drinking fountains
 - Bring a water bottle from home
 - Reuse disposable bottles, caps and caps
 - And don't forget to recycle!
- Transportation**
 - Walk
 - Carpool/catch a bus
 - Cat pool

Vampire Energy Sucks...

Appliance	Power
Cell Phone Charger (standby)	3w
Power charger (standby)	3w
Speakers (standby)	6w
Printer (standby)	12w
Overhead Projector (standby)	32w
DVD player (standby)	8w

We need a Kill a Watt meter to measure power use by some common classroom and household devices when not in use but plugged in. These devices quietly suck energy the vampire sucking blood. The Department of Energy estimated we spent \$1 billion a year on vampire energy in 2005.

In the City

We looked around Tempe for examples of how to reduce energy use in the city.

Take the bus or the light rail. Public transport uses much less energy than driving.

Trees provide shade and help keep the streets cool. They make the city more attractive for walking.

If we can keep the city cooler it means we don't need to use as much energy for air conditioning. This parking lot has a light colored pervious concrete that doesn't get as hot as asphalt.

Urban Heat Island

Some materials absorb and store heat from the sun more than others. This makes our cities get hotter and we then use more energy for air conditioning. We need heatproof roofs and landscaping to minimize the temperature of our surfaces at night on March 13.

Shade is the best way to stay cool and but we also found light colored surfaces are good too because they reflect the sunlight. Concrete was a little better than grass or grass but asphalt was much better. The test result was hot because it is natural and the other surfaces were heatproof.

Surface	Light	Dark
light	~100	~150
light	~100	~150
light	~100	~150
dark	~100	~150

good concrete grass tree woodshrub

Acknowledgements.

Tempe High students and staff partnered with APS and ASU School of Sustainability with funding from NSF to create the Sustainability First at Tempe High initiative. This poster was created by J. Hauer, N. Forrest and the following 150 students: J. Boudin, T. Brown, A. Houston, C. Lantz, C. O'Brien, K. Parker, S. Pham, J. Rabe, R. Vargas, G. Vazquez.

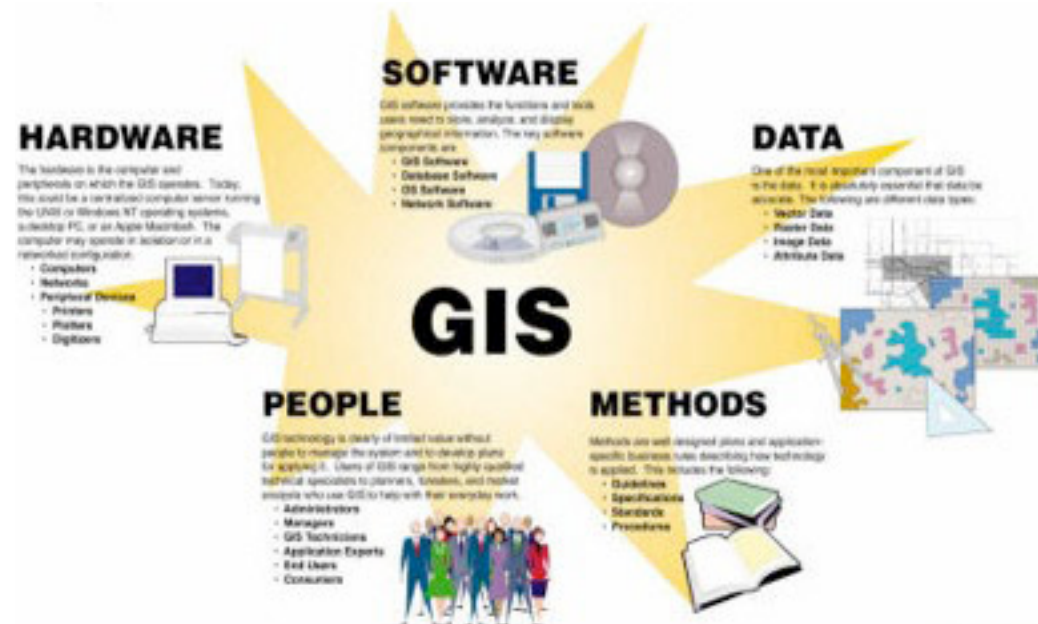


Intro to Sustainability 1–2 Course

- Career & Technical Education (CTE)
- Topics
 - Introduction to Sustainability
 - Land & Ecosystems
 - Food
 - Consumption & Waste
 - Supply Chain
 - Energy
 - Climate & Weather
 - Water
 - Health & Well-Being
 - Humankind & Civilization
 - Sustainable Management
 - GIS
 - Change Agent for Sustainable Solutions (CASS)

GIS, Career Exploration and STEM

- “Examining Your Environment through the Power of Data” (EYE-POD)
 - NAU sponsored project
- \$10,000 worth of resources
 - ArcView GIS
- Sustainability students learn the technical aspects of GIS software while investigating real phenomena
- Sustainability students participate in laboratory demonstrations and field data collection using Labquest handheld field measurement systems



Class activities

- BioBlitz: National Geographic sponsored Environmental Assessment of Saguaro National Park
- Williams Institute Essay Contest
 - Ethics in Sustainability
- Next year: AZ Game and Fish Heritage Grant (outdoor classroom and schoolyard habitat)



THS Sustainability Class

Living Laboratories: Green Leaf Project

Classes:

Special Education

Biology

Culinary Arts

Art

Child Development



Earth Week – Passport to Sustainability



Who: THS student body, staff,
community

What: Earth day celebration to highlight
student achievements, strengthen
sustainability awareness on our
campus, promote career awareness in
STEM

When: Thursday, April 19th Earth Week

Where: THS track/ football field

Earth Week <small>Friday April 20th 6:00-8:00 PM</small>				
Monday April 16	Tuesday April 17	Wednesday April 18	Thursday April 19	Friday April 20
Eat food cooked on solar ovens! ***** 	Public Service Announcements created by YOUR Terrace High classroom! 	Learn how to make soap from THS' own Mr. Cooper! 	Tour THS student gardens! Plant a seed and watch it grow! 	Earth Day Even though there is no school today, you can celebrate with your friends and family by celebrating Earth Day celebrations from across the valley! 

No Impact Week

- First high school
- Themes
 - Consumption
 - Waste
 - Food
 - Energy
 - Water
 - Giving back
- Movie viewing on lawn
 - Wall-E
 - Documentaries



Other Campus activities

- Green Products (soap) and Reusable Bags
 - Art Club
- Community wide E-waste recycling drive
- Aeropostale's Teen Jean Drive
 - STUCO
 - Key Club
 - Sustainability PLC



The ASU Engineering College
Challenge for High School
students:
Sustainable Doghouse Robotics
Competition

Field Trips



- Looking for community-based sustainability projects
- The Hayden Mill
- Community gardens
 - Valley of the sunflowers
- Tour de Tempe
 - Sustainable energy in the city

Collaborations and Project Based Learning

- Hayden Flour Mill Project
- Sustainability Problem Solving Framework
- “Transformational” research
- Student led projects
 - Community Voices
 - Chalk Walk
 - Community Art Space
 - Storyboards
 - Community Garden



Lessons Learned



Challenges Faced

- Potential lack of clarity among team members
- Need for resources
- Developing skills of fellows
- Keeping up with the activities of fellows
- Change is hard!

Overcoming the Challenges

- Potential lack of clarity among team members

Individual School Charters

- Need for a variety of resources

Development of a toolkit (5 day & 1 day lessons)

- Developing skills of fellows

Summer & weekly leadership training

- Keeping up with the activities of fellows

Weekly project tracker sheet

- Change is hard!

Be patient and build in redundant reminders

Question

- Do you have an idea of a new way to integrate sustainability into your school/facility?

Find out more about the program.
Visit: sustainableschools.asu.edu



Camp Energy

1. The Basics

- Introduce lesson and Camp Colley

2. Nonrenewable Energy Sources

- Where do fossil fuels come from?

3. Renewable Energy Sources

- What are renewable energy sources?

4. Let's Work Together

- Energy portfolio creation

5. Presentations

- Presentations and wrap-up

The Second C: Campus

Turning the campus into learning environment

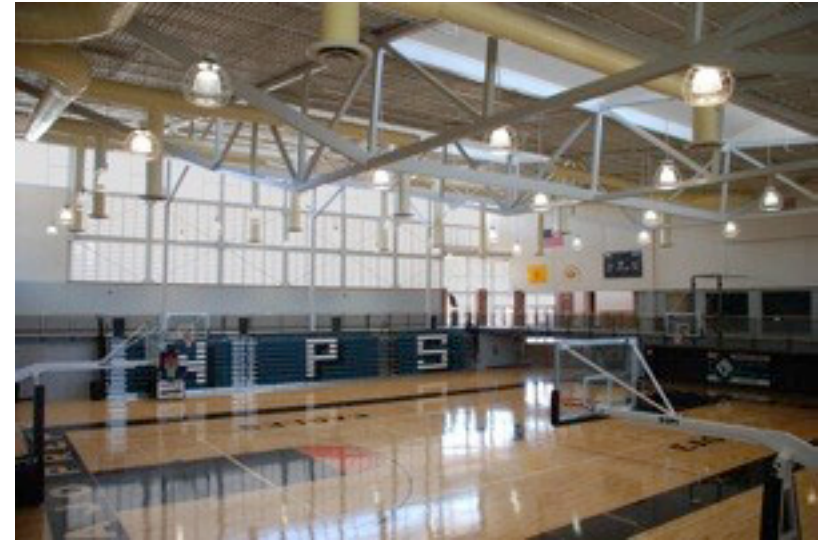
- Sustainability PLC's
- Staff–Faculty–Student committees
- District policies and practices
- Sustainability projects



Energy Conservation



Solar
production



Resource Efficiency –
facility design to show
the “bones”



Daylighting Design

Renewable Energy



BioScience –
Hybrid Car



Wrigley Hall – Wind Turbines



Navajo Prep –
Passive solar and
natural ventilation

Water Conservation



Metro Tech – Building
Rain-Water Harvesting
System

Low Water Use Plumbing Fixtures



are0064 www.fotosearch.com

Waste Management & Recycling



ASU's Engrained – waste management program: reduce, reuse, recycle



Vermi composting practices



Outdoor/Ecosystem

Metro Tech –
edible orchard



Tempe – learning
gardens



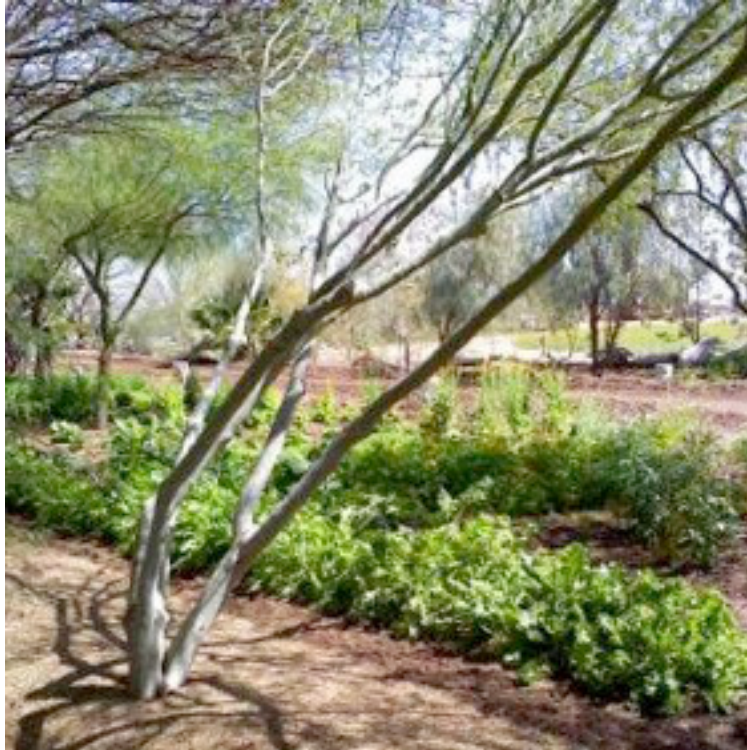
Schoolyard Biodiveristy

Food



MetroTech's Culinary Program

Supply Chain



Local Food Sourcing – Metro
Tech from Singh Farms

Sustainable purchasing
policies



The Third C: Community

- Sustainability projects for the community
- Partnerships with business and industry

