Tempe Climate Action Plan: Adaptation Strategies

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Project Overview

The city of Tempe has recently joined the Compact of Mayors, which is an agreement to lower the city's greenhouse gas emissions in a two year time frame.

Our goal: develop adaptation efforts and an urban cooling plan in order to adapt to climate change impacts.

Project Overview

We started with identifying the different research categories

Researched different city's Urban Cooling Plan and other climate adaptation strategies

Analyzed our findings and entered our recommendations into an Excel spreadsheet

Solid Waste and Recycling

Garbage Truck Proposal

- Garbage trucks average 2-3 miles per gallon
- Replace engines in garbage trucks with hybrid systems
- In the meantime, check diesel particulate filters within the garbage trucks and replace if necessary

Flagstaff Hybrid Buses

Flagstaff now has diesel hybrid electric buses along with many other cities in the world (Baltimore, Pittsburgh, and San Francisco to name a few)

Companies like Hybrid Electric Vehicle Technologies convert vehicles to have hybrid engines

Renewable Energy & Energy Efficiency

Solar Panel Shade Units

Renewable energy

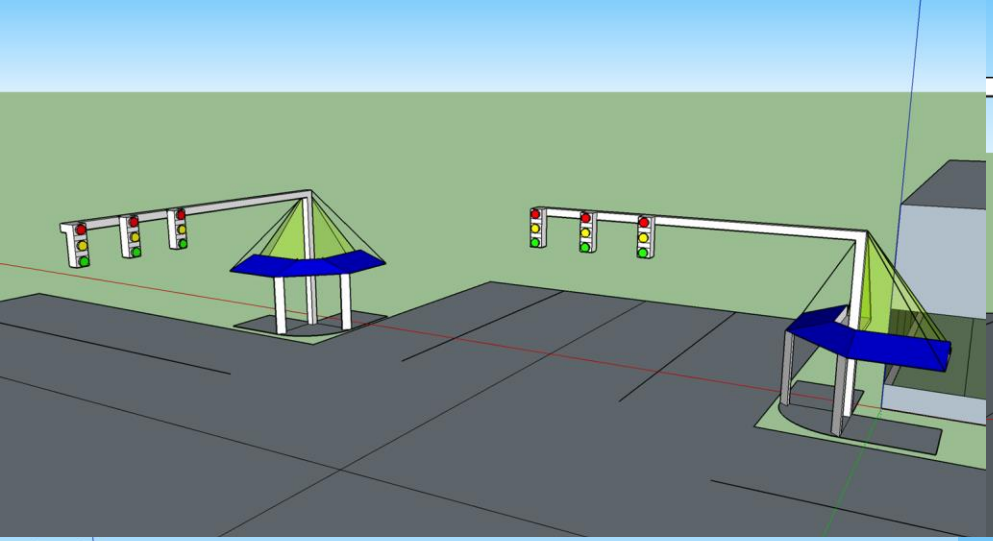
Reliable

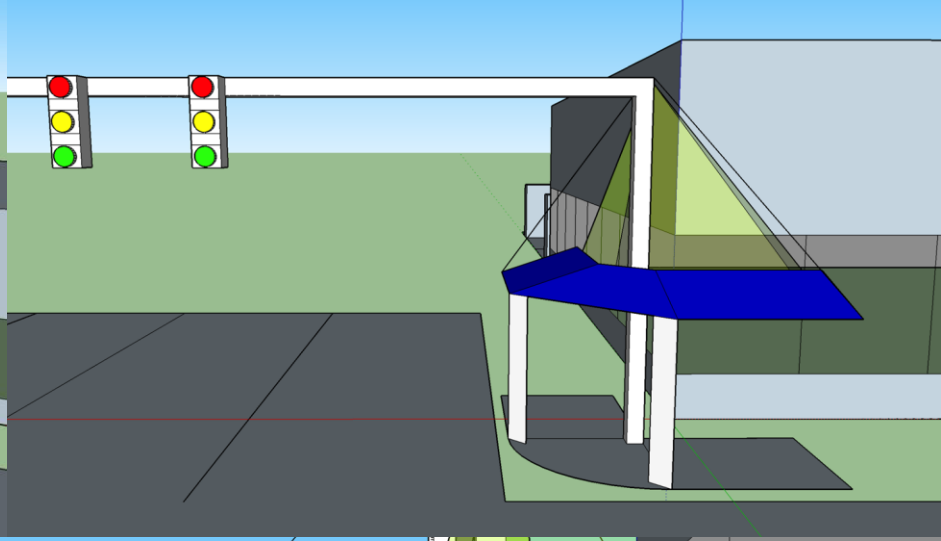
Sturdy and Adaptable

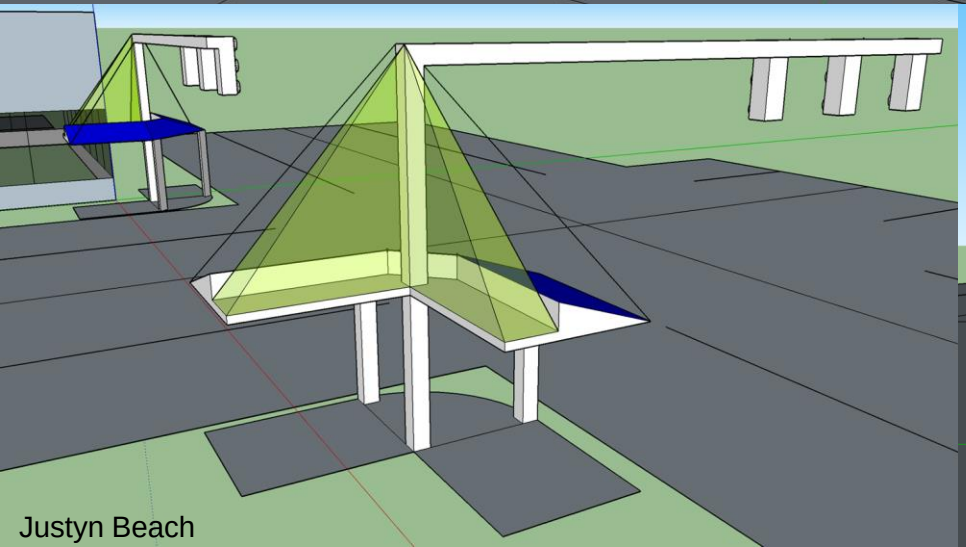
Easily Customizable

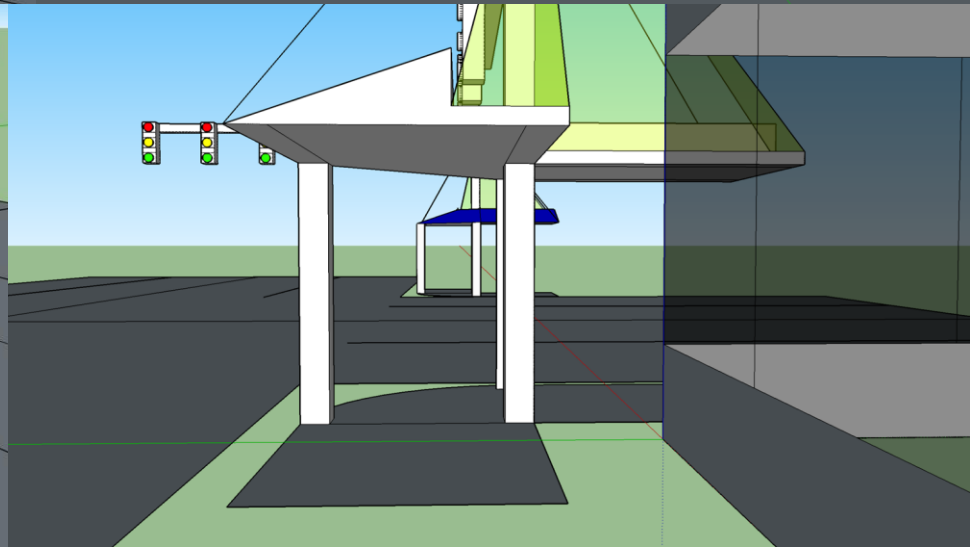
Improves Quality of Life

Supports the 20-Minute City









Justyn Beach

Transportation

Green Roofing... for Buses!

Project is done my PhytoKinetic

Tested in Spain

Fights against the heat island effect

Saves energy use

Uses waste water from AC units for the garden

Experimental but so far successful

PhytoKinetic works with cities and adapts idea their to any city

Bus Shade Shelters

Ensuring safety and comfortability for public transportation users is a priority

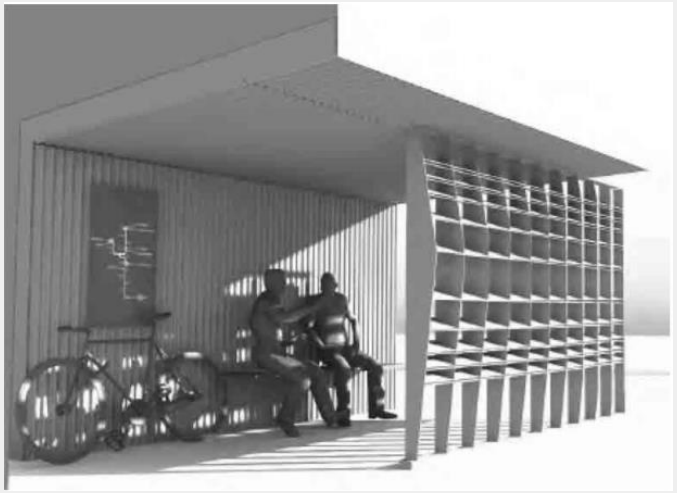
Some bus stops are not shade effective

Primary users are more vulnerable

to the extreme heat than automobile users

Improvements in Tucson

Tucson bus stops severely lacked shade shelters



Planted trees next to bus stops

Partnered with University of Arizona to design

Easter and Western light regulated by vertical

surfaces while southern light is regulated by horizontal services

Similar project being done in Phoenix

Water Conservation

Water Level Monitor Drip Irrigation Systems

ADEQ Greywater use compliant

Efficient

Conservative

Reliable

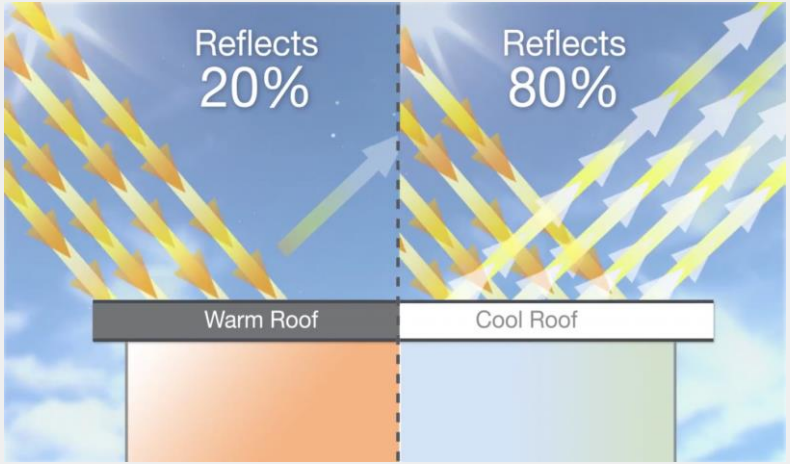
Affordable

RainBird

Eco Drip

Land Use & The Built Environment

Cool Roofs



- Roofs with high albedo that reflect heat off of buildings
- Reduces energy bills in buildings and also combats urban heat island effect

Hyderabad, India

Utilized cool roofs to reduce heat island effect, reduce building energy, and lower carbon footprint

Account for a reduction of 17.1kg/CO2/m2 in a year

These buildings also reduced their energy by 17.9 kWh/m2/year

Tree Placement & Shade

Palo Brea

Ironwood

ARIZONA DESERT SHADE TREES

Your one-stop guide to a variety of shade trees that grow well in the dry Arizona Sonoran Desert environment.

	Mature Specimens at Desert Botanical Garden?	Benefits			Okay to Grow Near Electric Lines? Y = Yes, N = No	Height	Shape	Spread	Growth Rate	Water Usage	Possible Problems		Frost Toler-ance	Tree Type	Potential Planting Areas	Native Arizona Shade Tree
		Beneficial to Native Wildlife	Heaviest Bloom Season: SP=Spring, SU=Summer, F=Fall, W=Winter	Flower Color: C=Cream, W=White, Y=Yellow, P=Pink, Prp=Purple, R=Red		S=<25', M=25-40', L=>40'	S-Spreading, M=Multi/Trunked/Low-forked, P=Pyramidal, N=Narrow, C=Conical	S=<25', M=25-40', L=>40'	S=Slow, M=Medium, F=Fast	L=Low, M=Medium	I=Iron Chlorosis, T=Texas Root Rot, D=Other Diseases, P=Pests, L=Litter, W=Wind Damage, In=Invasive Roots	Thorny: V=Very, M=Moderate, S=Slightly, N=No Thorns	Hardiness: Degrees Fahrenheit S=Semi-Hardy, H=Hardy	E=Evergreen, S=Semi-deciduous, D=Deciduous	T=Turf, D=Desert	
Aleppo Pine Pinus halepensis			N/A		N	L	S	L	M	M	D,P	N	H	E	T	
Blue Palo Verde Parkinsonia florida		▲	SP	Y	N	M	S/M	M	M	L	L	M	H	D	D	■
Cascalote Parkinsonia caesalpinia		▲	W	Y	Y	S	S	S	F	L	P,L	V	28/S	S	T/D	
Chinese Elm Ulmus parvifolia			SU/F		N	L	S	L	M	M	T,L	N	H	S	T	
Chinese Pistache Pistacia chinensis			SU		N	L	S	L	M	M	T,L	N	H	D	T	
Coolibah Eucalyptus microtheca			SP	P	N	M	S	M	M	M	I,L,W,P	N	H	E	T	
Coral Gum Eucalyptus torquata			N/A	R,Y	Y	S	S	S	M	L	T,D,P,L	N	H	E	D	
Desert Fern Lysiloma thornberi		▲	SP	C	N	S/M	S	S/M	M	L	L	N	S	E	D	■
Desert Willow Chilopsis linearis		▲	SP/SU	P/Prp	Y	S	N/M	S	M	L	L	N	H	D	D	■

metropolitan area & HIR strategy	annual energy savings [M$]	annual electricity savings [BWh]	annual electricity savings [M$]	annual natural gas deficit [Mth]	annual natural gas deficit [M$]	peak power avoided [MW]	annual carbon reduction [kt]
Baton Rouge							
base case	114.8	1275	92.8	30.7	21.9	858	213
direct shade tree	5.2	94	6.9	2.4	1.7	62	16
direct high albedo	8.0	120	8.7	1.0	0.7	60	20
direct combined	12.9	210	15.3	3.4	2.4	120	35
indirect	2.3	39	2.8	0.7	0.5	13	6
direct & indirect	15.0	248	18.1	4.3	3.1	133	41
Sacramento							
base case	296.2	2238	185.9	162.2	110.3	2454	374
direct shade tree	9.8	247	20.6	15.8	10.7	180	41
direct high albedo	14.6	220	18.3	5.5	3.8	163	37
direct combined	23.5	464	38.6	22.1	15.1	371	78
indirect	5.9	114	9.5	5.3	3.6	106	19
direct & indirect	26.1	554	46.1	29.4	20.0	486	92
Salt Lake City							
base case	67.0	511	31.4	70.8	35.6	488	85
direct shade tree	1.1	52	3.3	4.2	2.2	33	9
direct high albedo	1.8	45	2.8	2.0	1.0	32	8
direct combined	2.9	94	5.9	5.9	3.0	65	16
indirect	0.8	25	1.6	1.6	0.8	20	4
direct & indirect	3.6	116	7.3	7.3	3.7	85	20

Green Spaces

Are undeveloped and opened land in urban areas

Provide aesthetic value and environmental benefits

Provide shade and lower temperatures which reduce the urban heat island effect

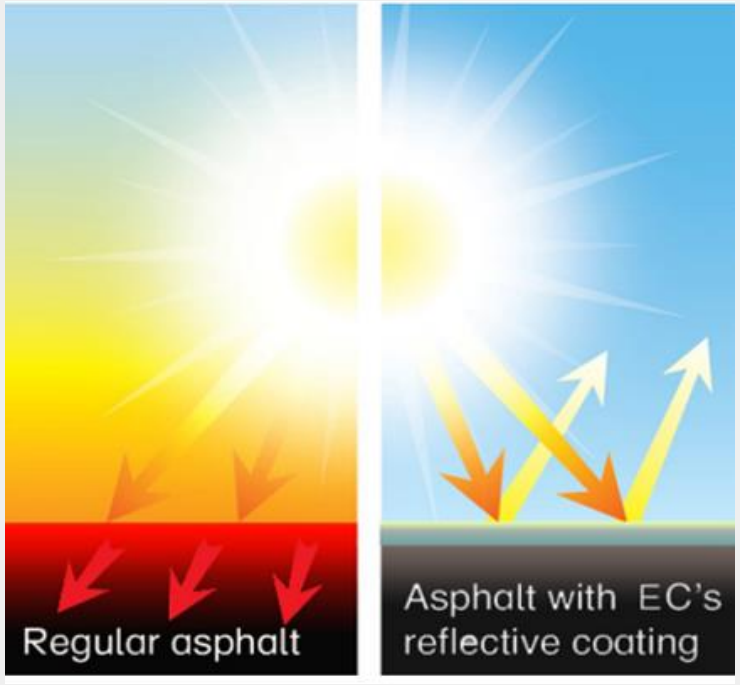
Civic Space Park- Phoenix, Arizona

2. 77 acres in the heart of Downtown Phoenix

Includes unique urban design and sustainable construction

More than 70% of the park is shaded with trees and vegetation

Cool Pavement



Stays cooler in the sun

Emerald Cool pavement reduces the surface heat of asphalt

On average, will reduce surface heat between 20-30 degrees

Robert Duffy High School- Phoenix, Arizona

One of the first emerald parking lots

24.517 sq feet that was coated with

nanocrete

This project avoided 22.429 tons of

carbon emissions

Reduced surface heat by 30 degrees

Permeable Pavement

Table 2. Effectiveness of Porous Pavement Pollutant Removal,* % by mass

Study Location	Total Suspended Solids (TSS)	Total Phosphorus (TP)	Total Nitrogen (TN)	Chemical Oxygen Demand (COD)	Metals
Prince William, VA	82	65	80	—	—
Rockville, MD	95	65	85	82	98–99

Century West Engineering Oregon

Lake George, New York

Challenges

Solid Waste and Recycling: Cost

Renewable Energy: Materials

Transportation: Collaboration and Teamwork

Water Conservation: Policy

High Albedo, Permeable Pavement: Time

Trees, Shade, & Green Spaces: Convincing Development Review Commission

Thank you!