

**GREEN SCHOOLS CASE STUDY
Davidson Elementary School**

School name: **Davidson Elementary School** – Tucson Unified School District
Address: 3950 E. Paradise Falls Drive, Tucson, AZ 85712
Contact: Robin Shambach, AIA, Principal - Burns and Wald-Hopkins Architects
Arthur Stables, Burns Wald- Hopkins Architects, Specifier
Phone number: 520-795-2705
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General location: North Tucson
Grade Levels: K- 5
Number of students: capacity: 450
Number of staff: 35 average
Superintendent/Principal: Arthur DeFilippo
Phone number: 520-232-6800

Physical descriptors:

Building area	40,000 sq ft	Number of stories	1
Number of buildings	9	Number of classrooms	20
Landscape area	~ 3 acres	Site area	9.8 acres

Date of “commissioning”: April/June//July 2006 - Moved into August 2006 – LEED Certified

School Cost:

Total construction cost: \$5,040,780
Cost per square foot: \$126.00
Additional funding sources: Special development project for TUSD
Grant from Tucson Electric Power for solar system

SUSTAINABLE SITES GOALS

Building area used as Community Space
Erosion and Sedimentation Control
Site Selection
Reduced Site Disturbance - Development Footprint
Landscape and exterior design to reduce heat islands - non roof
Light Pollution Reduction

Sustainable sites strategies used

Set the school as low as possible and still drain – saves cutting and filling costs, preserves view from neighborhood to the mountains over the school
Preserve vegetation as able
Maintain a path through site from north to south (walkway to west of school)
Make building available to community for use

Results obtained

Building area used as Community Space: 13% or 5200 square feet. The Multipurpose Room has a platform with curtains and public address system for use at community meetings. The Library also is able to be separated from other functions for use during off hours.

WATER EFFICIENCY GOALS

Water efficient landscaping reduce by 60%
Water Use Reduction 20% reduction
Water Use Reduction 30% reduction

Water efficiency strategies used

Reclaimed water for irrigation except Kindergarten grassy areas (children health safety)
Waterless urinals
Metered faucets
Water efficient landscaping no potable use or no irrigation
Innovative wastewater technologies

Results obtained

Waterless urinals (save approximately 160,000 gallons for the school per year)
Indoor water consumption (July 1, 2006 – June 30, 2007) 1,081 ccf or 808,588 gallons per year. A typical school in this area uses 1857 ccf or 1,389,036 gallons year. Water efficiency strategies used are saving approximately 580,000 gallons per year
Reclaimed water is supplied by Tucson Water from the city distribution system
Reclaimed use (for landscape irrigation) is 4498 CCF or 3,364,700 gal/year
Savings on water - \$2,462.15 or 18 percent

Additional information:

Including water saving devices increased overall cost YES NO

Payback period not known at this point – overall savings of 40% quantity on water usage compared with standard fixtures; we did consider using reclaimed water for toilet flushing but that was discarded due to additional cost for piping within site.

Overall, incorporating water saving devices into the school was worthwhile YES NO

Overall, incorporating water saving devices into the school was worthwhile YES NO

ENERGY AND ATMOSPHERE GOALS

Fundamental building systems commissioning
Minimum Energy Performance
CFC Reduction in HVAC & R Equipment
Optimize energy performance - 43% reduction
Renewable energy 5 %
Ozone depletion

Energy and atmosphere strategies used

Energy sources: electric, natural gas, solar

HVAC type	rooftop package w/energy recovery	Number of Units:	35	BTU Rating:	1,197,400 total
Insulation R-Values	Roof	R-30	Walls	R-13	
Window types	tinted low E 1 insulating units				

Efficient HVAC system -- including Heat Recovery Units (thermal wheel, good building insulation, high performance glass.

High efficiency direct/indirect lighting – glare free, energy efficient; light level sensors at classrooms (adjust light to outside light conditions); occupancy sensors at utility spaces (like a store room – shuts off lights when no one present).

Renewable energy – provide 5% of school total energy use through photovoltaic electricity generation (TUSD funding and TEP (Tucson Electric Power) grant) – 9KV of electricity generated by panels mounted on shade canopies (act as shading themselves). The system cost approximately \$38,400 and was funded through the Tucson Solar Schools Project with additional support from TEP. It is a Grid-tied system with 60-BP 3160 panels and 3-Xantrex GT3.0 inverters generating 9.6 kW DC capacity to provide 5% of the new school's energy demand. TEP paid for the installation and provided additional savings on the equipment through its SunShare program.

Performance measurement equipment installed in this facility: None

On-Site Renewable Energy

Type & Quantity produced: 9kW photo-voltaic

Green energy purchased: **No**

Results obtained

HVAC system saves about 25% in energy costs per year over typical buildings.

Savings in first cost for “right-sized” HVAC units over traditionally-sized units, \$65,000.

Energy Savings estimate: 14,400 kWh per year.

Total energy innovations save Davidson 39% or \$57,093 on utility bills compared to comparable TUSD schools.

Energy Consumption

System/District Average Electric / year 11,248,300 kWh

\$ 11,386,859.80 Cost

System/District Average Gas / year 1,714,678 therm

Electric/year [This facility]	year 2006-07	\$ 2,310,904.89	Cost
		757,922	kWh
		\$ 83,647.82	Cost
Gas/year [This facility]	37 percent savings or year 2006-07	\$42,239.58	Savings
		3,372	therm
		\$6,691.44	Cost
	67 percent savings or	\$12,539.98	Savings

MATERIALS AND RESOURCES GOALS

Storage and Collection of Recyclables

Recycled Content – Specify 5% (post consumer + ½ post-industrial)

Recycled Content – Specify 10% (post consumer + ½ post-industrial)

Local/regional materials, 20% manufactured locally

Local/regional materials, of 20% above, 50% harvested locally

Results obtained

Storage & Collection of Recyclables (during school year)

Average monthly weight or volume of materials recycled - 24 cubic yards

Materials separated and recycled: glass, plastic, paper, cardboard

\$149.08 or 10 percent increase in costs for solid waste removal

Integrated material strategies used

Minimized the use of finish materials (ceiling tiles etc.)

Employed recycled materials where possible.

Results obtained

Recycled Content: Blue Jean Insulation from a company in Casa Grande

Local and Regional Materials: Blue Jean Insulation from a company in Casa Grande

Buildings constructed of tilt-up concrete panels: Locally produced material, fabricated on site, simple, durable material

Many recycled materials used: Insulation made from cotton waste; walk-off mats made of old tires; steel doors and frames, reinforcing steel, structural steel fabricated of recycled steel; recycled paper on drywall

Minimize materials: Insulation exposed in MP and classrooms; stained concrete floors

Additional information:

Recycling during the construction phase was

Very easy easy average difficult **very difficult** n/a

Finding materials with recycled content was

Very easy **easy** average difficult very difficult n/a

Finding materials to “reuse” was

Very easy easy average difficult very difficult **n/a**

INDOOR ENVIRONMENTAL QUALITY GOALS

Minimum IAQ Performance
 Environmental Tobacco Smoke Control
 Ventilation Effectiveness
 Low emitting Materials (Adhesives and Sealants)
 Low Emitting Materials (Paints)
 Low emitting materials (Carpet)
 Indoor Chemical & Pollutant Source Control
 Controllability of Systems, perimeter
 Controllability of systems, non-perimeter
 Thermal Comfort (Comply with ASHRAE 55-1992)
 Daylight and views – views for 90% of spaces

Indoor environmental quality strategies used

Carbon dioxide monitoring of all spaces and regulation with introduction of outside air
 Non-toxic (low-emitting) materials used: Paints, sealers, adhesives, carpets
 Provide daylight and views from all spaces: Maintain connection to the exterior (all spaces also directly go to the exterior)

<i>Area of daylighted classrooms and with outside views</i>	<i>16,255 sq. ft.</i>
<i>Area of other regularly occupied daylighted common spaces with outside views.</i>	<i>7000 sq. ft.</i>
<i>Percent of total building area that is daylighted with outside views.</i>	<i>58%</i>

Results obtained

Perception is that the school is well and comfortably lit.

Additional Information:

Finding materials with low VOC content was:

Very easy **easy** average difficult very difficult n/a

The benefit from incorporating daylighting as been:

Very beneficial **beneficial** no change not worth the effort

Students and staff **like** *dislike* the daylighting aspects of the buildings.

Staff absenteeism has decreased **Yes** No Specific reason for decrease unk

Student absenteeism has decreased **Yes** No Specific reason for decrease unk

Asthma attacks have decreased **Yes** No Specific reason for decrease unk

INNOVATION AND DESIGN PROCESS GOALS

Green Cleaning
Education Program
LEED AP

Innovation and design strategies used

Have an education program that explores with students features of construction that make it more sustainable and why it is important – such as signage, pamphlets, and perhaps direct visual monitoring of PV output.

Additional feature: The Rillito Neighborhood Natural Resource Park is a joint venture of Davidson Elementary School, Pima County (Neighborhood Reinvestment Program) and the City of Tucson (Parks and Recreation Department). The partners are developing a natural resource park on the school grounds which will be used as an outdoor classroom for students and a recreation facility for the neighborhood. The park will include an American with Disabilities Act (ADA) playground for children of all abilities, a fitness course exercise trail, and a natural resource part with native plants, ramadas, tables and trees. Davidson School students have participated in the development and planning of this project for the past year, and the project has created positive energy and unity among the Davidson School students and staff and the Rillito neighborhood residents. (from community Development and Neighborhood Conservation Department News Vol 2, Iss 1, fall 2006)

The school uses eco-friendly cleaning products.

OVERALL BENEFITS TO DAVIDSON ELEMENTARY

The green projects included in the design and operation of this school have improved the overall efficiency of the campus: **Yes** **No**

TRAINING

Staff attended trainings on Green Schools Operations and Maintenance? **Yes** **No**

Has staff attended trainings on energy efficient operations? **Yes** **No**

Staff has attended trainings on water conservation? **Yes** **No**

Has staff attended trainings on pollution prevention for transportation? **Unknown**

LESSONS LEARNED

During build phase: Subcontractor and General Contractor cooperation is very important to attain desired results – they do not always understand the goals and if they do, they are more apt to try to meet them.

After completion: Training for occupants and maintenance personnel very important, for instance, on this project the automatic control of the lights in the classrooms (motion and light monitoring for daylight) were misunderstood until direct training instituted.

We have been able to use the “green” features of our school as teaching tools:

Yes **No**

Specifically we have developed signage highlighting salient features of school; integrated recycling program (cardboard, paper, news-print, bottles, plastics) and energy saving program (REAP) into the education program.

The students study alternative ways of producing energy and investigate technologies that could replace other sources of energy that cause more pollution.

Students and staff **like** *dislike* the daylighting aspects of the buildings.

The green projects included in the design and operation of this school have improved the overall efficiency of the campus: **Yes** **No**

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