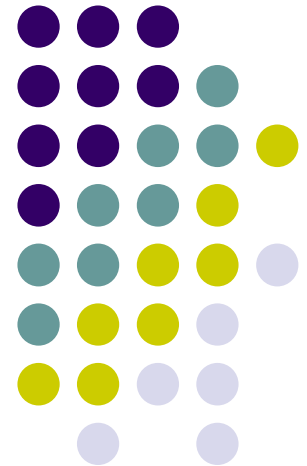


Scottsdale Green Building and Solar Trends 1998-2019



City of Scottsdale Green Building Program

Anthony Floyd, FAIA, LEED-AP, NOMA, CEM
City of Scottsdale
Office of Environmental Initiatives



Green Building Program Collaboration with other City Programs & Initiatives

1. General Plan Elements
2. Planning & Zoning Ordinances & Stipulations
3. Sensitive Design Principles
4. Energy Code
5. Water Conservation Ordinance
6. City Facility Management
7. Housing Rehab Office



SCOTTSDALE

AZ

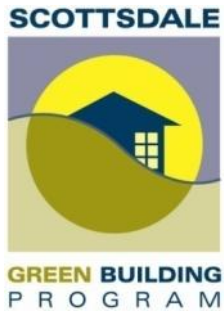




City of Scottsdale Green Building Program

- **Established in 1998**
 - Rating criteria based on Sonoran Bioregion
- **Verification Process**
 - Building plan review, permits and inspections
- **Public Outreach**
 - Engagement with project owners, developers, architects, builders and interested citizens
 - Pre-application project meetings
 - Green Building Lecture Series
- **Periodic Updates**
 - Green Home Rating Checklist v4.0
 - International Green Construction Code (2015 IgCC) for commercial and multifamily projects





Program Incentives

- **Scottsdale Green Building Designation**
- **Streamlined Documentation & Verification Process**
- **Technical and Permit Process Assistance**
- **Zero Application and Certification Fee**
- **Enhanced Market Niche**
 - city designation and listings
- **Promotion Material and Educational Programs**
 - web site resources, logos, certificates, job site signs, building plaque, lecture series



Green Building Lecture Series

- 1st Thursday of month
- Granite Reef Senior Center
- Average attendance - 30



SUSTAINABLE BUILDING IN THE DESERT

SCOTTSDALE



GREEN BUILDING
PROGRAM

CITY OF
SCOTTSDALE
GREEN
BUILDING
LECTURE
SERIES
2018/2019

Scottsdale
Granite Reef
Senior Center
located at
1700 N. Granite
Reef Road
(NW corner of
McDowell &
Granite Reef
Roads)

7 to 8:30 p.m.

Free Admission

October 4, 2018

The Circular Economy: Reduce, Reuse, Recycle, Reconsider & Re-imagine

In a traditional linear economy, materials are made, used and disposed of in the landfill. In a circular economy, resources are kept in use for as long as possible to extract maximum value, then recovered to regenerate new materials. Circular economies divert waste from landfills, reduce environmental impacts, conserve energy and water, and save money. Hear about community initiatives, business efforts and what you can do to support a circular economy.

December 6, 2018

Future Proofing: Carbon Neutrality & Energy Efficiency in New & Existing Buildings

While renewable energy reduces the need to produce energy from dirty sources in the future, energy efficiency reduces the need to produce energy now. Energy efficiency is among the most cost-effective ways to reduce carbon emissions, making it a key part of fighting climate change. Learn how you can reduce environmental impacts and improve the prospects for a bright future with the buildings we live and work in.

February 7, 2019

Living an Edible Landscape Life

Come join in the conversation and be inspired to grow as urban gardeners share the benefits and how-to's of growing your own healthy food, herbs, edible flowers and fruit trees in our desert environment. Learn about our planting and harvesting seasons, as well as the importance of seed saving. Hear the latest news about ancient grains. Includes a lively, interactive food tasting experience for all ages!

April 4, 2019

Radiant Cooling & Other Alternatives to Conventional Air Conditioning

Did you know that 43% of all electricity consumed in Phoenix metro area homes is used for air conditioning? Learn about mean radiant temperatures and efficient ways to remove heat while improving thermal comfort and saving energy. Discover the advantages of radiant cooling systems and hydronic technologies.

June 6, 2019

Cutting Edge Residential & Commercial Green High-Performance Buildings

What are the technological trends and building prototypes for the 21st century? Who are the early adopters and market leaders? Come see and hear about successful innovative residential and commercial projects that exemplify principles of resource conservation, energy independence and healthy living.

Scottsdale Building Trends 1998 – 2019

● Energy Efficiency

- Energy code updates with enhanced performance
- Cathedralized attics (insulation at underside of roof decks)
- Energy Star products, LED lighting and solar ready zones
- Third-party energy raters and building commissioning

● Indoor Environmental Quality

- Fresh air ventilation and bathroom exhaust fan auto controls

● Water Efficiency

- Xeriscaping and efficient irrigation systems
- High-efficiency plumbing fixtures
- Efficient hot water delivery systems

● Heat Island Mitigation

- Recessed entrances, shaded outdoor spaces and courtyards

● On-Site Solar Generation

- Growing number of solar PV installations and battery storage⁶



Over 1400 Green Designated Homes from 1998-2019



Silversmith Residence - Tate Studio Architects



Eldorado on 1st Condos – Will Bruder Architects



Becker Residence – Perry Becker Architect



The Douglas Scottsdale – John Douglas Architects

2019 Green Building Projects

- **Single-Family**

- Green Custom homes (5 new project submittals; 6 under construction)
- Green rehabilitated homes (7 building permits issued)



Tate Studio Custom Home



2019 Green Building Projects

- **Townhomes and low-rise Apartments**
 - MZ 2 (11 units) completed
 - Eclipse (20 units) completed
 - 70th Street Lofts (15 units) issued building permits
 - Monterey Villas (4 units) in review



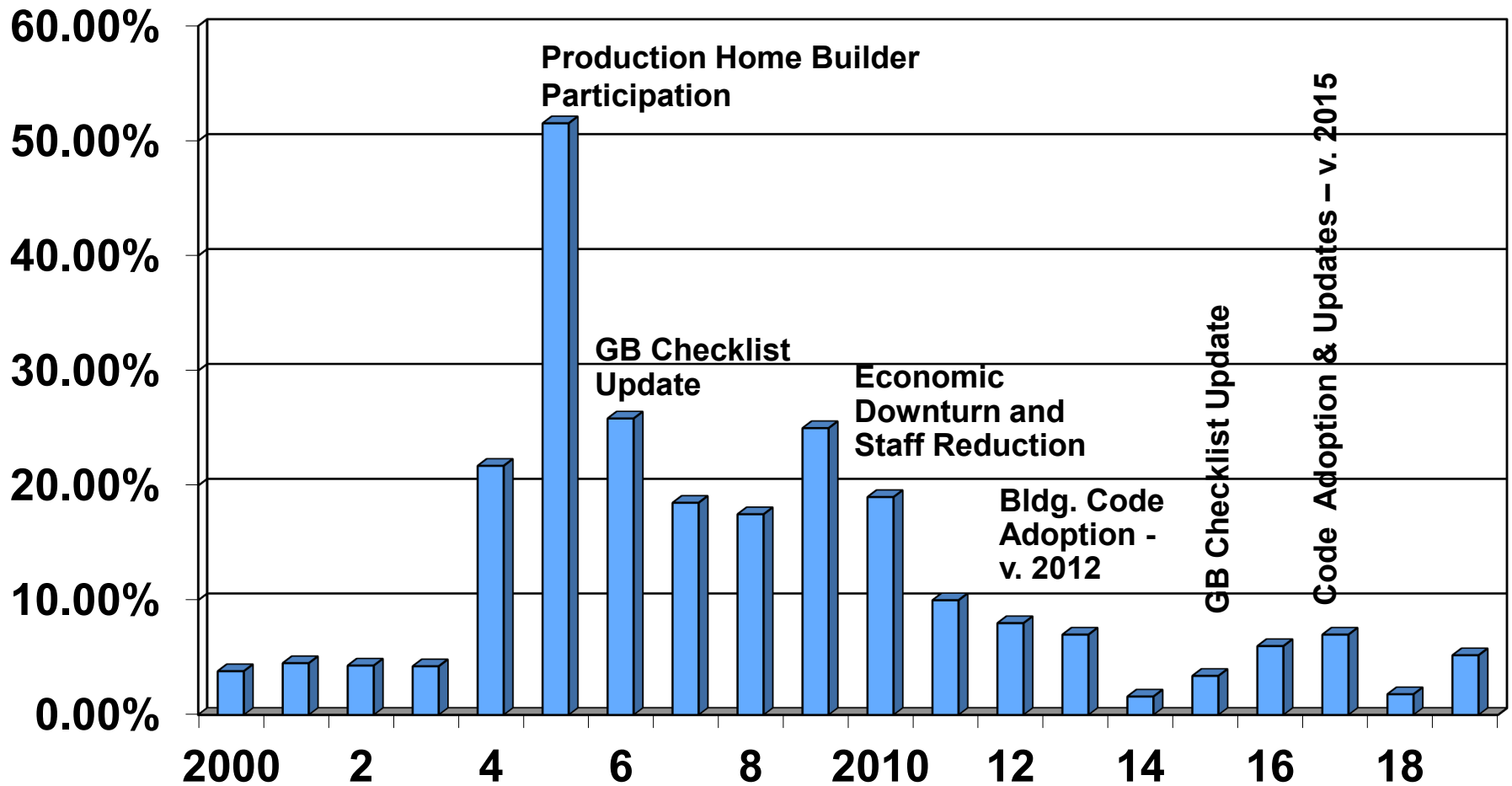
70th Street Lofts - Modus Development



Monterey Villas – Moderna Architecture

Percentage of Green Single Family and Townhome Permits

1998 - 2019



Source: Scottsdale CDS records

Green Single Family & Townhome Permits (1998 - 2019)

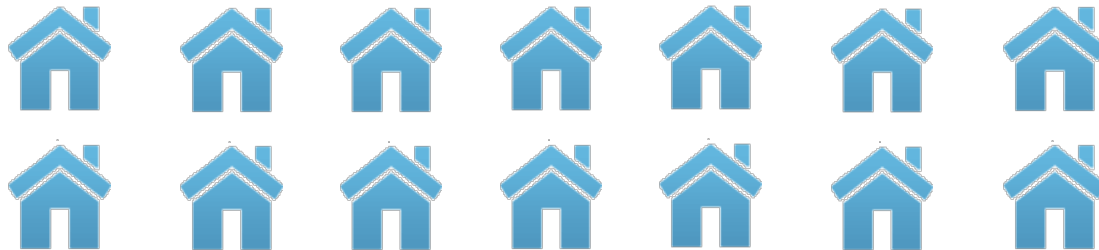
Year	Total Permits	Green Permits	Percentage of Total Permits
1998	2172	20	1%
1999	1554	36	2%
2000	1076	41	4%
2001	843	38	5%
2002	768	33	4%
2003	896	38	4%
2004	1137	247	22%
2005	852	439	52%
2006	685	177	26%
2007	573	106	19%
2008	200	35	18%
2009	121	30	25%
2010	149	28	19%
2011	155	15	10%
2012	265	21	8%
2013	400	26	7%
2014	440	7	1.6%
2015	438	15	3.4%
2016	525	29	6%
2017	560	38 (7 SFR; 31 townhomes)	7%
2018	569	10 (3 SFR; 7 rehab's)	1.8%
2019	593	31 (6 SFR; 15 townhomes; 10 rehab's)	5.2%
Total	14,946	1,445	9.7%

Source: Scottsdale CDS records

Green House Gas Reduction as a result of 1,445 Green Homes



Annual reduction of **5,491 tons of carbon dioxide (CO₂)**
equivalent to removing **1,058 cars** from the streets



Source: epa.gov/energy/greenhouse-gas-equivalencies-calculator

Energy Savings and Environmental Impact Reduction based on Average Size Green Homes

Estimated energy savings and equivalent greenhouse gas reduction resulting from houses completed under the Green Building Program.

Green Home Energy Measures	Annual Energy Savings and Pollution Reduction	
	Per Home	Total Savings for 1,445 green homes in 2019
<u>Average</u> Size Home¹	2,700 square feet	
Average Annual Energy Reduction¹	4,634 Kilowatt hours (kWh)	6,696,130 Kilowatt hours (kWh)
Average Annual Energy Cost Savings	\$554.23 per year (0.1196 per kWh) ²	\$800,862.35 (0.1196 per kWh) ²
Equivalent Annual Greenhouse Gas Reduction³	3.8 tons of carbon dioxide (CO ₂) avoided	5,491 tons of carbon dioxide (CO ₂) avoided
Equivalent Passenger Vehicles removed from Street³	0.738 passenger vehicles	1,067 passenger vehicles
Equivalent miles driven by an average passenger vehicle³	8,453 miles	12,214,585 miles

Sources: ¹Scottsdale Green Home Energy Study (2009); ²electricitylocal.com/states/arizona/scottsdale; ³epa.gov/energy/greenhouse-gas-equivalencies-calculator

Energy Savings and Environmental Impact Reduction of Average Custom Green Homes

Estimated energy savings and equivalent greenhouse gas reduction resulting from houses completed under the Green Building Program.

Green Home Energy Measures	Annual Energy Savings and Pollution Reduction	
	Per Home	Total Savings for 1,445 green homes in 2019
<u>Average</u> Size Custom Home¹	5,500 square feet	
Average Annual Energy Reduction¹	11,183 Kilowatt-hours (kWh)	16,159,435 Kilowatt-hours (kWh)
Average Annual Energy Cost Savings	\$1,337.49 per year (0.1196 per kWh) ²	\$1,932,673.05 (0.1196 per kWh) ²
Equivalent Annual Greenhouse Gas Reduction³	9.2 tons of carbon dioxide (CO ₂)	13,394 tons of carbon dioxide (CO ₂) avoided
Equivalent Passenger Vehicles removed from Street³	1.8 passenger vehicles	2,601 passenger vehicles
Equivalent miles driven by an average passenger vehicle³	20,398 miles	29,475,110 miles

Sources: ¹Scottsdale Green Home Energy Study (2009); ²electricitylocal.com/states/arizona/scottsdale; ³epa.gov/energy/greenhouse-gas-equivalencies-calculator

Scottsdale Commercial Projects - 2019

- **Projects complying with Green Construction Code (IgCC) or LEED**
 - Optima Sonoran Village (176 units) completed
 - Vitri at Scottsdale Quarter (301 units) under construction
 - Canopy Hotel by Hilton (177 rooms) under construction



Vitri Apartments



Canopy Hotel

Scottsdale Commercial Projects - 2019

- **Projects complying with Green Construction Code (IgCC) or LEED**
 - Gramercy Safari (160 units) under construction
 - Springhill Suites Hotel (117 guest rooms) under constr.
 - Broadstone Papago Marketplace (274 units) under constr.



Springhill Suites Hotel



Gramercy Safari

Scottsdale Commercial Projects - 2019

- **Projects complying with Green Construction Code (IgCC) or LEED**
 - DC Hotel (169 guest rooms) under construction with underground parking garage
 - Caesars Republic Hotel (265 guest rooms) in review

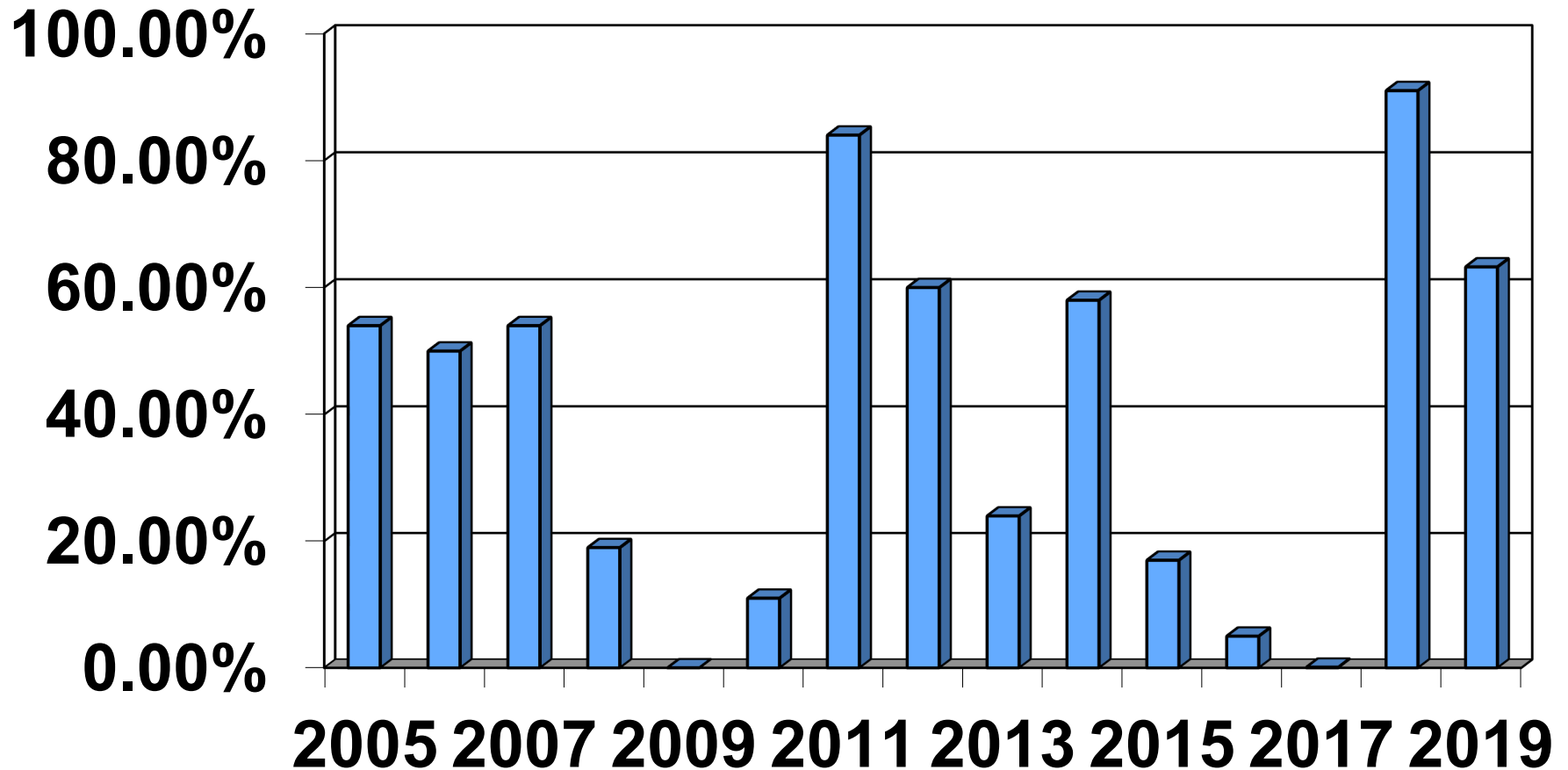


DC Hotel



Caesars Republic Hotel

Percentage of Green Multifamily Dwelling Permits for Condos, Apartments and Hotel Buildings 2003 - 2019



Source: Scottsdale CDS records

Green Multifamily Dwelling Unit Permits (2003 - 2019)

Year	Total Permits	Green Permits	Percentage of Total Permits
2003	1,500	5	0.3% - Includes 5 units at Loloma 5 Townhomes
2004	1,025	0	0%
2005	483	261	54% - Includes 253 units at Optima Camelview Village, 8 units at The Duke EarlI Drive Townhomes
2006	743	373	50% - Includes 299 Optima Camelview Village units, 74 units at Safari (non-green units include Waterfront Towers, Monterey, Barolo)
2007	621	335	54% - Includes 198 Optima Camelview Village units, 96 at Corriente, 38 at Safari, 3 at Engle Villas Desert Park Village (non-green units include 17 at Waterfront Towers, 6 at Canavest, 6 at Hancock, 8 at Eagles Pass, 93 at Artesia, 18 at Villa Contendo, 36 at Paseo Village, 100 at Sage, 2 at Clayton)
2008	402	76	19% - Includes 56 Optima Camelview Village units, 8 at Engle Villas at Desert Park Village, 10 at Upton, 2 at Safari (non-green units include 68 Silverstone apartments, 16 at Encore Grayhawk, 9 at Artesia, 18 at Wilshire, 7 at Courtyards at Desert Park, 2 at Hancock, 3 at Residences on Main, 203 at Classic Residences at Silverstone)
2009	24	0	0% - (non-green projects include 5 at 6 th Street Lofts, 8 at Encore Grayhawk, 8 at Courtyards at Desert Park, 3 at Hancock)
2010	264	29	11% - Includes 28 Optima Camelview Village units, 1 Meritage model (non-green projects include 118 at Princess Maravilla Casitas, 14 at Courtyard Desert Park, 12 at Encore Grayhawk, 80 at Ten Lofts, 11 misc.)
2011	301	254	84% - Includes 210 Optima Sonoran I units, 44 at Optima Camelview Village (non-green projects include 39 at Princess Maravilla Casitas, 8 at Encore Grayhawk)
2012	1,024	613	60% - Includes 325 SkySong units, 264 at Broadstone Lincoln, 24 at Corriente (non-green projects include 388 at TDI One Scottsdale)
2013	2,128	507	24% - Includes 200 Optima Sonoran II units, 259 at Broadstone Waterfront, 48 at Corriente (non-green projects include 416 at Mark Taylor on McDowell, 369 at Portales, 303 at TDI One Scottsdale, 49 at Sage, 220 at Archstone DC Ranch, 240 at Liv North, 24 at Pinnacle Point/Eagle Pass)
2014	1,798	1,033	58% - Includes 202 units at Optima Sonoran Village II; 267 at Scottsdale Quarter Crescent ; 556 at Clayton Apartments; 8 at Project MZ
2015	758	130	17% - Includes 89 at Envy Condos; 41 at Equinox Apartments
2016	741	33	5% - Includes 10 condo units at SOHO; 7 units at Eldorado on First; 16 units at Plaza Osborn Apartments
2017	1,000	1	0.1% - Final condo unit built-out at Envy Condos
2018	524	477	91% - Includes 176 condo units at Optima Sonoran Village; 301 apartment units for Vitri at Scottsdale Quarter
2019	2	2	100% - Includes Canopy Hotel and DC Hotel
2019	604	160	26.5% - Includes 160 dwelling units at Gramercy Safari Apartments
Total	13,942	4,289	31%



Scottsdale City Resolution for LEED Gold Certified City Buildings

14 LEED certified buildings including 4 Platinum (2005 – 2019)



Airport Operations Center – LEED Silver



Museum of the West – LEED Gold



Appaloosa Library – LEED Gold



Downtown Fire Station 2 – LEED Platinum



Scottsdale City Resolution for LEED City Buildings completed in 2019

- Fire Station 613 (certified)
- Aviation Business Center (waiting certification)
- Fire Stations 603 and 616 are under construction



Fire Station 613

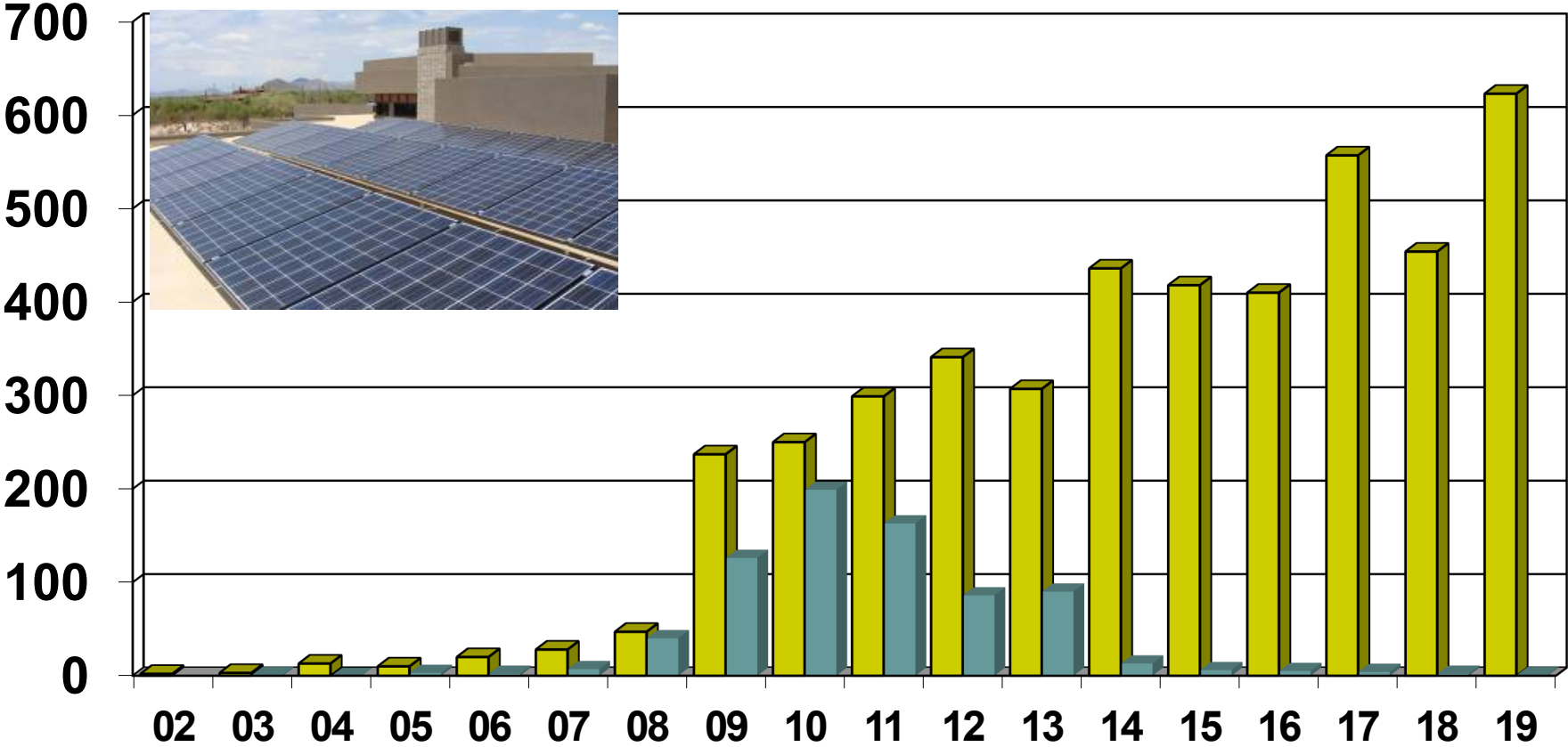


Aviation Business Center

Solar Permits 2002 to 2019



5,203 solar PV and hot water installations (7.3% of 71,092 owner-occupied homes).



Source: Scottsdale CDS permit records

Solar Permits 2002 to 2019

Solar Electric (PV)

4,455 solar PV permits issued

Year	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
No. of Permits	2	3	13	10	20	28	47	237	250	299	341	307	436	418	410	557	454	623

Solar Hot Water

748 solar hot water permits issued

Year	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
No. of Permits	-	1	0	3	2	7	40	126	199	163	86	90	13	6	5	4	2	1

Note: Many early solar permits (2002 – 2008) were designated as minimum electrical, plumbing or water heater permits.

Source: Scottsdale CDS permit records

On-Site Energy Generation and Environmental Impact Reduction of Solar Electric (PV) Systems

Estimated energy savings and equivalent greenhouse gas reduction resulting from installed roof top solar PV systems from **2002 to 2019**.

Green Home Energy Measures	Annual Energy Savings and Pollution Reduction	
	Per Home	Total Savings for <u>4,455</u> solar PV roof tops
Average PV system size	6 kW	
Average Annual On-Site Energy Generation¹	10,427 Kilowatt hours (kWh)	46,452,285 Kilowatt hours (kWh)
Average Annual Energy Value¹	\$1,246	\$5,550,930
Equivalent Annual Greenhouse Gas Reduction²	8.1 tons of carbon dioxide (CO ₂) avoided	36,086 tons of carbon dioxide (CO ₂) avoided
Equivalent Passenger Vehicles removed from Street²	1.6 cars	7,128 cars
Equivalent miles driven by an average passenger vehicle²	18,294 miles	81,499,770 miles

Sources: ¹pvwatts.nrel.gov; ²epa.gov/energy/greenhouse-gas-equivalencies-calculator
²epa.gov/energy/greenhouse-gas-equivalencies-calculator



Office of Environmental Initiatives

Planning and Development

Green Building Program

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www.scottsdaleaz.gov/greenbuilding