Following a disastrous flood from an overflowing toilet and a leaking swamp cooler on the roof, we were faced with major repairs...or a major refit. We opted for the latter and embarked on a re-design and re-build of our 1600sf house, which was built - along with tens of thousands just like it - in 1984. The typical builder’s “3-Bedroom” plan simply didn’t suit our way of life - so we changed almost everything.

Having lived in our remodeled house for over four years, we have found that our energy consumption has dropped by more than 60% by comparing our APS bills before and after the renovation.

Step one. We made the building envelope (walls, roofs, windows and doors) as energy-efficient as we could within our budget. We replaced the existing leaky sliding aluminum windows with new low-e glass, wood-clad, fiberglass casements by Milgard. We also spray-foamed the underside of the roof and the inside face of gables with 6”-8” of 1/2 lb foam insulation and replaced the asphalt shingles with a standing seam metal roof, which has a high reflectivity Kynar 500™ finish. We also took the air conditioner off the roof and replaced it with a ground level, high efficiency, two-stage 16 SEER heat pump linked to a high efficiency air handler situated in an interior closet. We pioneered the installation of a PEX-based fire sprinkler system - the first of its kind approved by the City

Step Two. after one year of monitoring energy usage from within our more energy efficient building envelope, we installed a 6.7 kW solar power array on the south-facing roof to generate well over 95% of our electricity over the course of a year. Such a system is a lot smaller than it would have been had we not achieved a more efficient building envelope. Thus we were able to afford to install PV panels designed for Phoenix temperatures rather than install many more cheaper panels, which only perform well in much lower ambient temperatures.

Standing seam metal roofs enable PV panels to be attached to mounting posts clamped to the standing seams using very strong set-screws. This avoids drilling holes through to the structure beneath, significantly decreasing the risk of rainwater leaks.
Here are some other images showing the house before and after the major re-fit.

Exteriors before the renovation.

New, open floor plan and room layout

Tight interior layout and dark corridors before the renovation

Room dividers in living/dining/kitchen areas are 6ft high plywood bookshelves anchored through to the floor slab

Desert landscaping to eliminate watering or sprinklers

The re-built house as seen when entering the neighborhood