

Return on Investment Analysis for Energy Efficiency and Solar for an Average U.S. Home

Metrics	Value	Units	Notes	Source
<i>Energy efficiency (light)</i>				
Avg annual kWh/US household	11,478	kWh	For 2018 from EIA	<a href="https://www.eia.gov/totalenergy/data/monthly/for_consumption;FRED_for_number_of_HHs">https://www.eia.gov/totalenergy/data/monthly/for_consumption;FRED_for_number_of_HHs</a>
Avg annual gas.US household	404	therms	For 2018 from EIA	<a href="https://www.eia.gov/totalenergy/data/monthly/for_consumption;FRED_for_number_of_HHs">https://www.eia.gov/totalenergy/data/monthly/for_consumption;FRED_for_number_of_HHs</a>
Energy savings	9.8%		Derived from CT Energy Solutions impact evaluation	<a href="https://www.energizect.com/sites/default/files/HES%20and%20HES-IE%20Impact%20Evaluation%20%28R16%29%2C%20Final%20Report%2C%202012-31-14.pdf">https://www.energizect.com/sites/default/files/HES%20and%20HES-IE%20Impact%20Evaluation%20%28R16%29%2C%20Final%20Report%2C%202012-31-14.pdf</a>
Average energy savings	1,125	kWh	Product of average use and % savings	
	40	therms		
Avg cost of retrofits	\$ 1,000		Approx. cost of services per home	<a href="https://www.uinet.com/wps/portal/uinet/smartenergy/rebatesandprograms/home_energy_solutions/">https://www.uinet.com/wps/portal/uinet/smartenergy/rebatesandprograms/home_energy_solutions/</a>
Average residential electricity price	\$ 0.1289	/kwh	For 2018	<a href="https://www.eia.gov/electricity/monthly/current_month/epm.pdf">https://www.eia.gov/electricity/monthly/current_month/epm.pdf</a>
Average residential natural gas price	\$ 1.016	/therm	For 2018; in \$/CCF; adjusted for therms	<a href="https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPGO_PRS_DMcf_a.htm">https://www.eia.gov/dnav/ng/ng_pri_sum_a_EPGO_PRS_DMcf_a.htm</a> <a href="https://www.eia.gov/dnav/ng/ng_cons_heat_a_EPGO_VGTH_btucf_a.htm">https://www.eia.gov/dnav/ng/ng_cons_heat_a_EPGO_VGTH_btucf_a.htm</a>
Simple payback	\$ 5.4	years		
Return on investment	18.5%			
<i>Energy efficiency (medium)</i>				
Energy savings (HP with Energy Star)	29%		Avg for comprehensive retrofits in NJ	<a href="http://www.energy.gov/sites/prod/files/2014/03/f12/BA%20Webinar_Liaukus_3-19-14_0.pdf">www.energy.gov/sites/prod/files/2014/03/f12/BA%20Webinar_Liaukus_3-19-14_0.pdf</a>
Average energy savings	3,328	kWh	Product of average use and % savings	
	117	therms		
Avg cost of retrofits	\$ 14,082			<a href="http://www.energy.gov/sites/prod/files/2014/03/f12/BA%20Webinar_Liaukus_3-19-14_0.pdf">www.energy.gov/sites/prod/files/2014/03/f12/BA%20Webinar_Liaukus_3-19-14_0.pdf</a>
Adjust to 2018 \$	\$ 14,997		From 2014 to 2018	<a href="http://www.fred.stlouisfed.org/series/GDPDEF">www.fred.stlouisfed.org/series/GDPDEF</a>
Credit for HVAC replacement in 5 yrs	\$ (5,586)		Discounted cost of new furnace & AC, 5%/year discount rate	Furnace and AC costs from <a href="http://www.aceee.org/comparative-energy-use-residential-furnaces-and">www.aceee.org/comparative-energy-use-residential-furnaces-and</a>
Net cost	\$ 9,411		Sum of above two rows	
Simple payback	\$ 17.2	years		
Return on investment	5.8%			
<i>Energy efficiency (deep)</i>				
Energy savings	79%			Faesly & Wigington, "Scaling Up Electrification of Existing Homes," 2019 Home Performance Conf.
Average energy savings	9,067	kWh		
	319	therms		
Avg cost of retrofits	\$ 41,209			<a href="http://www.aceee.org/sites/default/files/ultra-low-energy-0717.pdf">www.aceee.org/sites/default/files/ultra-low-energy-0717.pdf</a>
Adjust to 2018 \$	\$ 42,957		From 2016 to 2018	<a href="http://www.fred.stlouisfed.org/series/GDPDEF">www.fred.stlouisfed.org/series/GDPDEF</a>
Credit for HVAC replacement in 5 yrs	\$ (5,586)		Would need to replace furnace & AC in ~5 yrs	Furnace and AC costs from <a href="https://www.aceee.org/comparative-energy-use-residential-furnaces-and">https://www.aceee.org/comparative-energy-use-residential-furnaces-and</a>
Net cost	\$ 37,371		Sum of above two rows	
Simple payback	\$ 25.0	years		
Return on investment	4.0%			
<i>Solar with full net metering</i>				
kWh/kW-yr	1394		For St. Louis, MO from NREL PVWatts	<a href="https://pvwatts.nrel.gov/">https://pvwatts.nrel.gov/</a>
kWh/home for 100% solar over a year	8.23	kW	Annual kWh/solar Btu/kW	Based on average US home energy use (in EE section) and output in row above
Solar system cost/kW	\$ 3.23	/kW	For 6-7 kW system in St. Louis, May 2019	<a href="http://www.solarreviews.com/solar-panels/solar-panel-cost/cost-of-solar-panels-in-missouri/solar-panels-cost-in-saint-louis-city-county/saint-louis/">www.solarreviews.com/solar-panels/solar-panel-cost/cost-of-solar-panels-in-missouri/solar-panels-cost-in-saint-louis-city-county/saint-louis/</a>
Cost of 8.23 kW system	\$ 26,594		Product of above 2 rows; does not include incentives or batteries	
Value of solar output at retail elec price	\$ 1,479		Based on US annual avg consumption and price	
Simple payback	18.0	years		
Return on investment	5.6%			
<i>Solar with time of use rate and net metering</i>				
Annual cost of backup power in Hawaii	\$ 610		For net metering with TOU rate	Lazar Jan. 2019
Adjustment for US avg kWh	1.79		Hawaiian homes use less energy than US average due to mild climate	
Adjustment for HI vs US \$/kWh	0.40		From EIA, Oct. 2018 year to date	Hawaii has high electric rates
Annual cost of backup power - US	\$ 439		Product of above 3 rows	
Solar savings net of backup power	\$ 1,040		\$1479-\$439 from above	
Simple payback	25.6	years		
Return on investment	3.9%			
<i>Solar with no net metering</i>				
Cost of backup power w/o net metering	\$ 680		For a 6 kW system; excess power sold to utility @\$0.045	<a href="http://www.solarpowerrocks.com/affordable-solar/get-home-solar-battery-2018/">www.solarpowerrocks.com/affordable-solar/get-home-solar-battery-2018/</a>
Adjustment for 8.23 kW system	\$ 932		Row above * 8.23/6	
Solar savings net of backup power	\$ 547		\$1479-\$812 from above	
Simple payback	48.6	years		
Return on investment	2.1%			