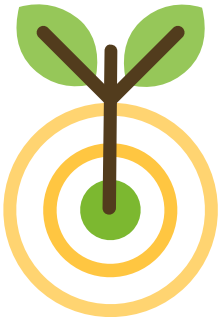
DENVER
THE MILE HIGH CITY

APPENDIX: CLIMATE

Conversion CO_2 to O_2



- Green roofs are expected to absorb and store carbon in plants and soils and thereby reduce the high CO_2 concentration levels in big cities.
- Study showed Sedum plants have high rates of CO_2 emission at daytime, when CO_2 concentration in the city is the highest.
- CO_2 emissions were not fully compensated by the nighttime uptake.
- Carbon sequestration may only be a secondary benefit of green roofs.
- Other plant species than Sedum should also be considered for use in green roofs, especially in Mediterranean and other semi-arid climates.

Source: Whittinghill, Leigh et al. 2014. "Quantifying carbon sequestration of various green roof and ornamental landscape systems." Landscape and Urban Planning. Vol. 123.

Heating Energy Savings

- Depending on what the green roof is like, there may or may not be a heating energy benefit
- There could even be a penalty for some types of inverted roofs
- In any case, increasing roof insulation will be more cost effective
- No benefit from partial green roofs

Cooling Energy Use

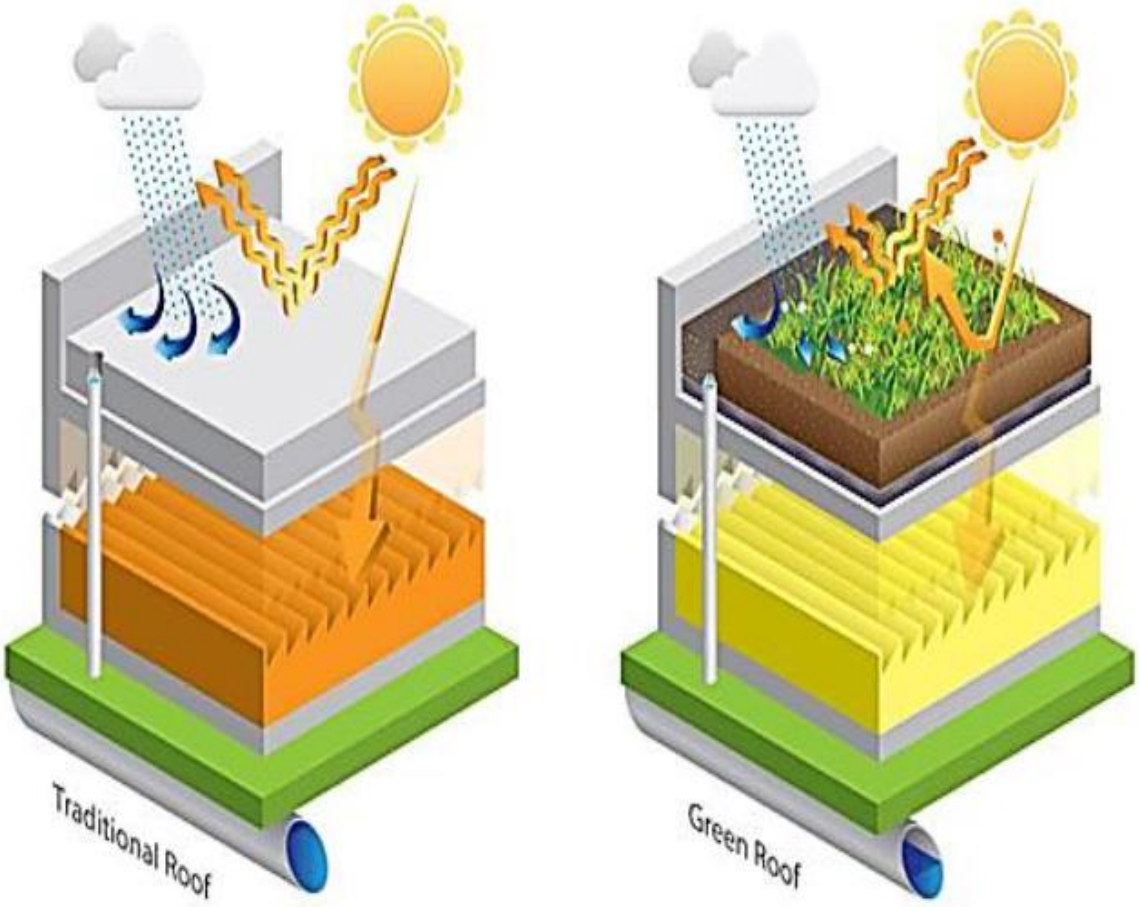
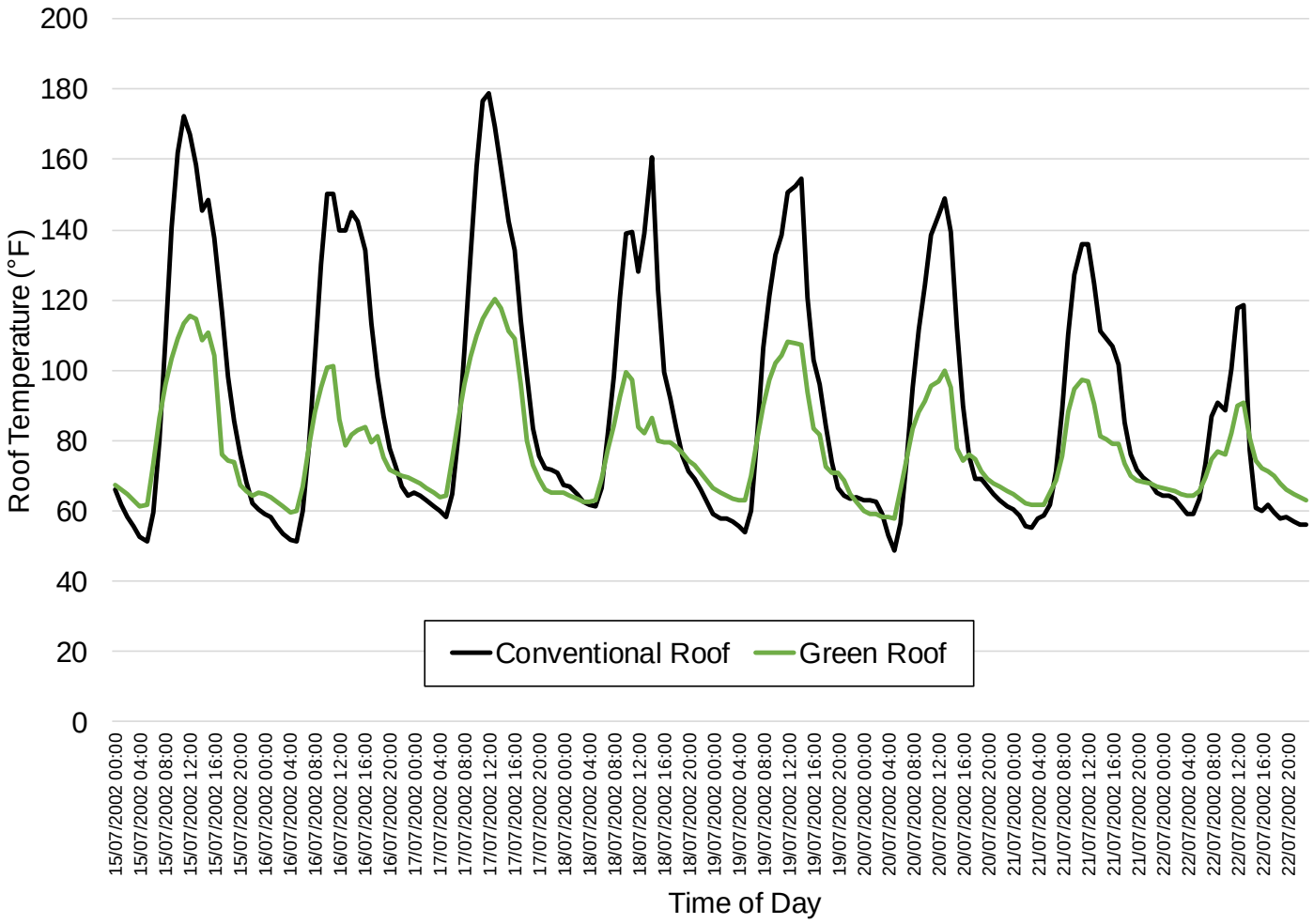


Image Source: Heidarinejad, Ghassem, and Arash Esmaili. 2016. "Assessment of green roof energy savings compared to conventional roof." eSim.

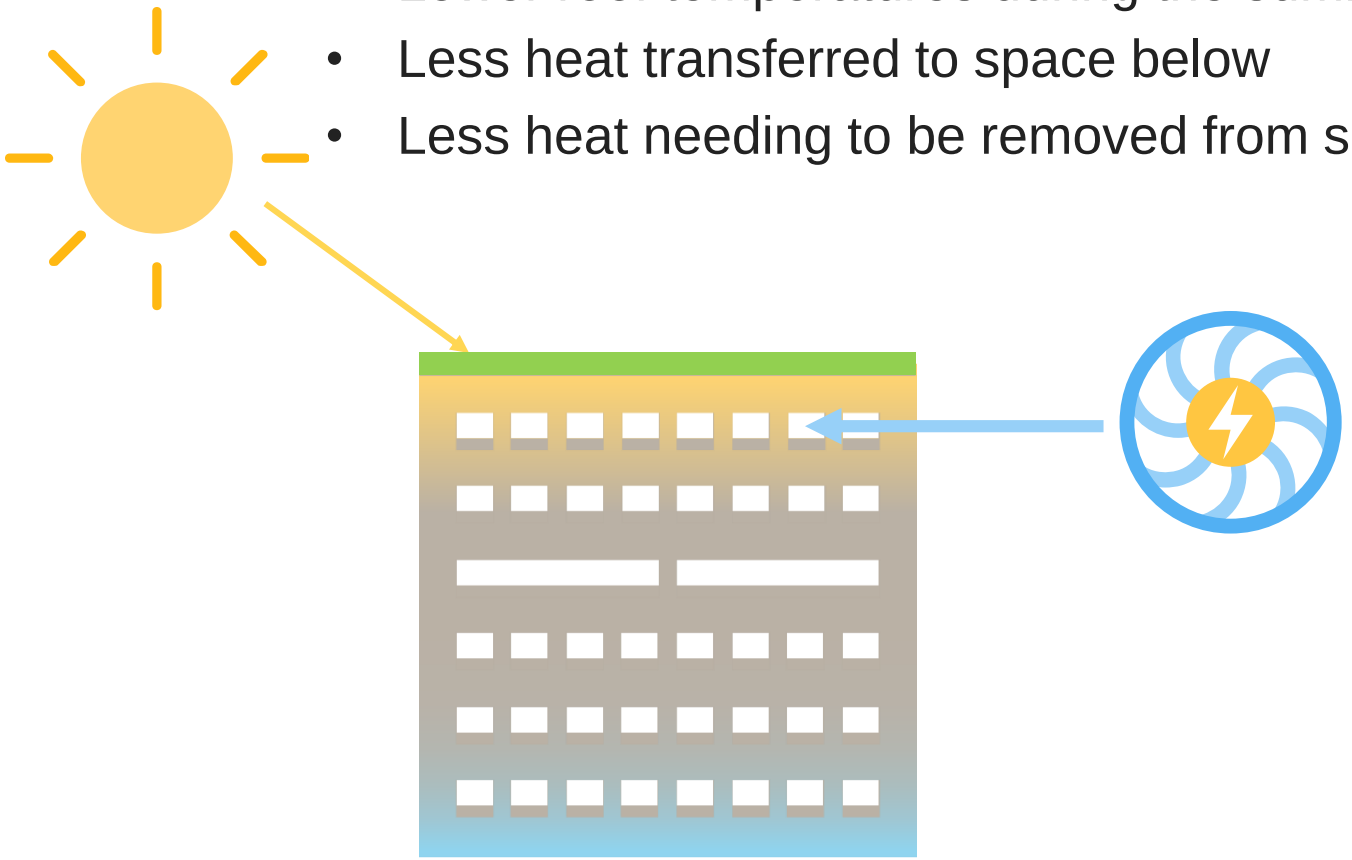
Roof Temperatures in Summer



Cooling Energy Savings

Cooling energy savings results from:

- Lower roof temperatures during the summer months
- Less heat transferred to space below
- Less heat needing to be removed from space below.



Water Pumping Energy

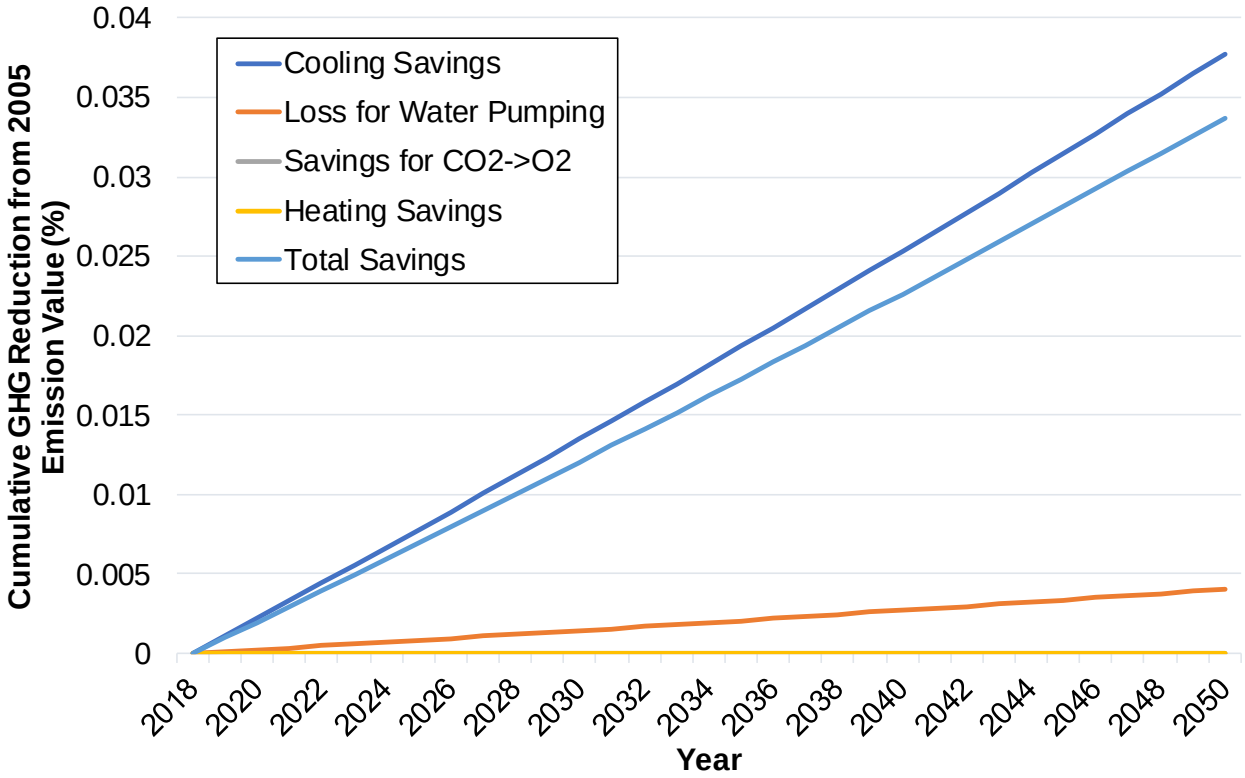
Water pumping energy includes:

- Energy to deliver potable water to site
- Energy to pump water to the roof

750 kWh per million gallons of potable water is required to deliver water to site*

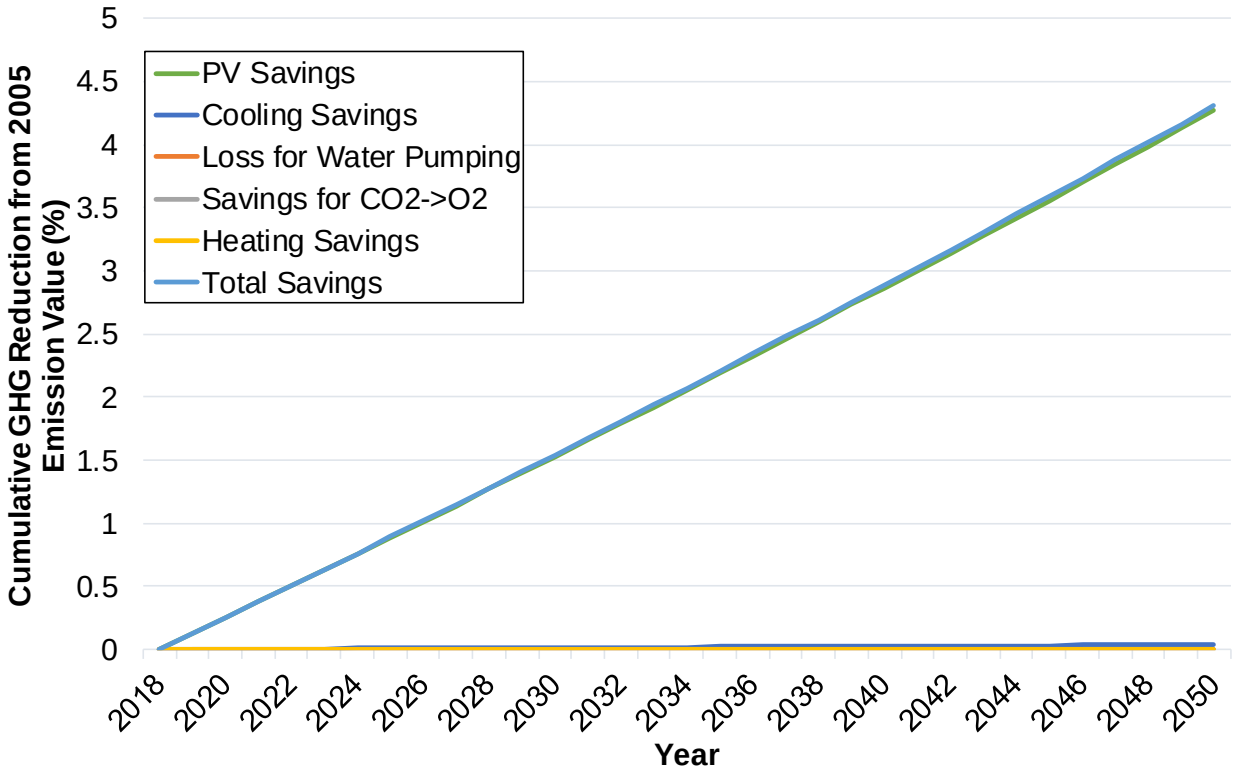
*Source:
https://coloradowater.charityfinders.com/documents/Annual%20Conference/2011%20Conference%20Presentations/2011%20Conference%20Presentations%20Wednesday/CO_WatershedOct2011_EnergyMgmt_BP.pdf

Green Roof Only: GHG Emissions Reduction



Parameter	Assumption
2005 GHG Emission Value	13.2 million mt-eCO_2
New Construction Growth Rate	1.5% per year
Roof Replacement Rate	4% per year

PV & Green Roof: GHG Emissions Reduction



Parameter	Assumption
Max PV Area	70% of green roof space
2005 GHG Emission Value	13.2 million mt-eCO_2
New Construction Growth Rate	1.5% per year
Roof Replacement Rate	4% per year