Designing and constructing buildings that can cool themselves entirely, or almost entirely, through passive means is a very real possibility, and one that needs to be considered more frequently in Utah. Many architects think that it is their job is to just design the building, and that the means through which the building is heated and cooled are for an engineer to figure out. In that type of scenario the architect is giving up a lot of the building to someone else, and is missing out on the opportunity to do so much more for the building and for the building’s occupants. When an architect designs a building with passive systems, be it just a few or systems or aiming for the entire building to have no need for mechanical systems, they and the client can gain so much more than if they don’t concern themselves with the heating and cooling of the building. There is potential to gain financially, aesthetically, and environmentally, as well as having the potential to gain in other indirect ways such as lowering the summertime strain on the grid and setting a positive example for developing countries.

For Utah in particular there is a very present need for passive cooling because of the large demand for cooling energy due to the hot and dry climate that is experienced in the summer. Since Utah is a relatively young state it doesn’t have a long history of passive cooling like some other states and countries do. This means that the public’s exposure to passively cooled buildings is slim to none, which results in poorly designed buildings in relation to cooling. A well designed building in terms of cooling uses a three step tiered approach, which begins with heat rejection. If a building can first reject heat then there is less energy needed to cool the building. This can be done with relative ease by correctly orienting a building and not placing windows in locations where they are most likely to be exposed to the heat of the sun (south and west), but rather placing them where they can get light, but not heat (north and east). The second step in designing a building that responds to cooling needs appropriately is by passively cooling it. Passive cooling is used to combat the heat that does make it into the building through techniques such as operable windows and night flushing. With operable windows a breeze can be drawn into the building through lower windows, and heat can be expelled from the building through higher operable windows. Additionally, a technique called night flushing can be used that also uses operable windows. This works best in climates where the nighttime outdoor air temperature drops below the indoor air temperature. When this happens the windows open and let the cool air in, then they close when the outdoor air temperature rises above the desired indoor air temperature. The last step in the cooling tier is mechanical systems. If heat rejection and passive cooling are not enough to lower the indoor air temperature of a building to the desired temperature range, then efficient mechanical systems should be installed to bridge the gap that is left. If the first two steps are followed and are incorporated as much as possible into the building’s design then when it comes time to size the mechanical system then its size and frequency of use will be dramatically reduced.

The techniques listed here are just brief examples, and there are countless others that can be used. The full thesis on this topic gives many more examples of passive cooling techniques that can be used through the analysis of three case studies and one hypothetical building in Utah. It goes into detail the reasoning, practicality, and possible applications going forward of each of these techniques. Additionally, it discusses the reasons and the numbers that support passive cooling if there is any doubt to the validity of passive cooling. By the end of the thesis the reader should have the basic tools to go forward and start implementing passive cooling into their future buildings.