West Virginia (WV) has seen recent growth in many ‘wicked problems’ - problems whose root causes are both complicated and interconnected. While the roots of these problems may be extensive, one area that may prove to be a practical solution is agriculture. Restoring agricultural production in WV in a post-coal era, utilizing modern, ‘green’ and sustainable techniques, will not only improve food security status and economic growth, but will ensure that engineering companies increasingly vie for stakes in WV’s future.

Over the last decade, WV farmland has declined by 72% and agriculture’s contribution to GDP fell by 25%. WV is experiencing high levels of unemployment (7.3%), and poverty (18%) (USDA, 2012), causing a 5% population decline over the last three decades. (US Census Bureau, 2011a). The food insecurity rate in WV is 14.2%, an increase of 5% over the last 2 decades, despite an increasing reliance on federal programs such as SNAP and WIC. WV currently ranks fourth in obesity nationally, and first and sixth in the rates of diabetes and hypertension, respectively (US Census Bureau, 2011b; US Department of Agriculture (USDA, 2011). WV ranks seventh in the nation for veterans per capita with 13.8% of our population being veterans (US Census Bureau, 2011a), and has an increasing amount of displaced coal-miners. Increasing agricultural production in WV can play a catalytic role in reducing unemployment, poverty rates, health issues, and out-migration. By implementing a sustainable, modern agricultural production system, WV can increase engineering and agricultural employment opportunities; provide healthier, fresh, and nutritious local food options for all residents; and stimulate rural economic activity.

Agriculture remains possible in WV, despite unique challenges including topography, and infertile and rocky soils, and reclaimed land mines. Vertical farming is a practice used mostly in urban settings that involves growing crops in large greenhouses, organized in layers or levels (Vertical Farming). The vertical farms employs hydroponic farming - a method that submerges crops in recirculated, nutrient-rich water, allowing plants to receive water and nutrients simultaneously. Plants are anchored in a soilless medium, to provide needed support. Because vertical farms are ‘closed-systems’, they can alleviate negative environmental externalities associated with traditional agricultural production, such as soil erosion and point-source pollution. There is also reduced water use because water is continuously recirculated.
Mountainous and less fertile areas in WV do not have the capacity to support large-scale farming operations, but adapting vertical farming for use in agriculturally challenged areas in WV can help improve agricultural production. These greenhouses can be situated virtually anywhere and can house a great square footage of crops that would not otherwise be possible given our terrain. However, appropriate buildings must be constructed or adapted in order to facilitate this agricultural growth. Vertical farms must be equipped with the fundamentals to support plant growth: lighting systems to distribute even, artificial sunlight and irrigation systems to provide water and transport nutrients. They also need temperature controls, an efficient insulation system, and a soil-less support medium in order to make farming possible year-round. Installing these features in multiple buildings in order to support agricultural growth in West Virginia will require feats of engineering and provide a great potential for return on investment, making vertical farming a logical choice to bring engineering companies to West Virginia.

Vertical farming systems do require a great deal of energy. While vertical farms alleviate negative agricultural externalities, such a system can also alleviate energy needs from coal production by utilizing geothermal energy instead. Geothermal heating and cooling allows you to take advantage of subterranean temperatures to provide heat in the winter and cooling in the summer. This is because 4-6 feet below ground, temperatures remain relatively constant year-round thanks to the insulating properties of the earth. Recent research suggests that WV is a geologically prime location for geothermal energy because of its high subterranean temperatures (Lawlor, 2010). This ‘free’ source of energy is harnessed through a system consisting of an indoor heat-pump unit, a buried system of pipes that transports the liquid heat-exchange medium (water), the air delivery system (ductwork), and/or a pump to a reinjection well if available (Egg, 2013). Unlike ordinary heating and cooling systems, geothermal systems emit no greenhouse gases and do not burn fossil fuel to generate heat; they simply transfer heat to and from the earth, working with nature, not against it. It also uses a smaller amount of electricity to run, because it works with the earth’s average temperature. Installing and maintaining the necessary infrastructure for these geothermal systems is a large enterprise that is massively appealing to many engineering companies.
While the concepts of vertical farming and geothermal energy systems are not novel, using them together in a system to increase agricultural production in a state plagued by agricultural impediments is an engineering and economic development innovation. By using geothermal energy systems to heat and cool vertical farms, young professionals can be trained to increase agricultural production using ‘green’ and sustainable farming techniques, creating a healthier state and accommodating dozens of openings for engineering companies. This innovation allows the state to increase the availability of fresh, nutritious foods with the smallest environmental footprint, using the least amount of land, water, and energy. By retraining young professionals, displaced coal miners, and veterans for jobs in vertical farming and geothermal energy systems, WV can provide safer, more prosperous jobs to its citizens, while stimulating rural economic development.

Vertical farms and geothermal energy will not only encourage engineering companies to move their businesses to WV, but encourage young professionals to remain in the state to take advantage of the increasing employment opportunities at home. By utilizing vertical farms and geothermal energy to spur agricultural growth, WV will no doubt “rise to the top”.

Works Cited: