



## 2019-2020 High School Innovation Challenge Guidelines

### Introduction

The High School Innovation Challenge at Red Rocks Community College (RRCC) is a competition that recognizes and rewards designs for sustainable change. We invite teams of 3-5 high school students, grades 9-12, to participate in a real-world design challenge that will propose innovations around sustainable energy, water, food, and environment. Student teams can either come up with their own problem related to the theme, or work on one that the teacher has chosen for the team. Each team will be required to state what problem they're trying to solve, what is the potential impact of their solution, and how society will benefit. Additionally, each team is required to make a short video about their design, as well as a physical prototype in the school's makerspace or other area designated by the school.

The top two design teams from each high school will present their design solutions at the IDEA Expo on **Tuesday, May 5, 2020** at 5:00pm at Red Rocks Community College to faculty, industry, and university partners. RRCC scholarships and prizes will be awarded to the top three solutions.

### Design Theme – Sustainable Designs in Energy, Water, Food, and Environment

Engineering is the profession of acquiring and applying scientific knowledge to balance the social (people), economic (profit), and environmental (planet) impacts when designing and building structures, machines, devices, systems, materials, and processes. Balancing the economic, social, and environmental impacts of a design makes it sustainable. As human populations continue to increase in Colorado and around the world the need for sustainable development has never been greater.

The United Nations defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [1]. Securing a prosperous future for humanity depends on the contributions that science, engineering, and education will make towards building sustainable pathways to meet the energy, water, and food needs of future generations. This theme calls for STEM projects that develop new or improve existing sustainability pathways.

Resources:

- Tools for design and sustainability [https://venturewell.org/tools\\_for\\_design/introduction/](https://venturewell.org/tools_for_design/introduction/)
- Projected world population 1950-2050  
<https://www.census.gov/population/international/data/idb/worldpopgraph.php>



- Colorado Department of Natural Resources Statewide Water Supply Initiative Report <http://cwcb.state.co.us/water-management/water-supply-planning/Pages/SWSI2010.aspx>
- United Nations Sustainable Development Knowledge Platform <https://sustainabledevelopment.un.org/>
- NSF-funded Sustainable Healthy Cities Project <http://www.sustainablehealthycities.org/>
- Arizona State University Global Institute of Sustainability <https://sustainability.asu.edu/>

## Rules

- Each team is required to get input on their design from an industry or community partner, such as a university professor, university student, local business owner, engineer, etc.)
- Maximum prototype budget is \$200. Prototype material lists and receipts will be collected as part of the design challenge submission. Materials that have been donated should be counted as part of the prototype budget.
- Materials that have recycled or repurposed into your prototype will not be included in the prototype budget. Recycled and repurposed materials are defined as materials previously used for purposes not related to the project.
- Digital and Written submissions are due no later than midnight **April 24, 2020**.

## Project Submissions

### **Digital Submission**

Engineering design teams are required to submit either a website or a 90 second video (minimum 720p video quality) describing their project. The problem, solution, impacts and college partner roles must be clearly identified.

Example Submissions:

- Denitrification of Farmland Wastewater <https://www.youtube.com/watch?v=0j3yZMepeAg>
- Solar Powered Water Well and Irrigation System <https://www.youtube.com/watch?v=tVzXDkbgxtQ>
- Plant Growth Stimulation and CO2 Reduction <https://www.youtube.com/watch?v=35jV7Fu42pc>

### **Written Submission**

In addition to the digital submission, design teams must submit a written description of their designs. The written description should detail a solution that includes the following information:

- a. Problem Statement (2,000 Character Limit) State the design parameters of your team's project. In this section, you should provide adequate background information on your



chosen problem and indicate why it is important that this problem be solved. The problem must be a real-world problem.

- b. Design Solution (2,000 Character Limit) Describe your design solution identifying how it will operate and function. Discuss the science and technology that your design will utilize.
- c. Design Schematic. Provide a detailed schematic image and a process diagram if applicable of your design solution. Your design schematics should be completed in some form of CAD (SolidWorks, AutoCAD, etc.).
- d. Sustainability Considerations (2,000 Character Limit) Sustainable management practices include environmental, social, and economic benefits that aid in creating a resilient solution. How will you measure the impacts of your solution? What benefits will be realized if your solution is implemented?
- e. Budget
  - Prototype Design
    - Provide a detailed list of all money sources and expenses for your prototype, submit all receipts for materials purchased to your teacher.
  - Full Scale Design Considerations
    - Provide a detailed explanation of important design considerations you will need to consider with the implementation of a full-scale product (i.e. performance, costs, impact, etc.)
- f. Industry or Community Partner (2,000 Character Limit) Identify your partner. Describe how your partner has been involved in your project and how they have helped your team identify potential design solutions.

### **Prototype**

A prototype of each design team's solution is required. The prototype is not required to be full scale but it should show the science behind how the solution works. It is strongly encouraged that design teams interact with their high school makerspace to create their prototypes.

Prototypes must be constructed only on school grounds (special consideration will be given to teams who lack access to an adequate build space).

### **IDEA EXPO**

Three design teams from each participating high school will be given an opportunity to pitch their proposed design at the **IDEA Expo on Tuesday May 5, 2020** (5 to 7 pm). Members of industry, RRCC faculty and representatives from other colleges will be present to judge finalists.

Prizes for winning teams will be handed out at the EXPO. Each team member of winning teams will receive the following

#### **1<sup>st</sup> Place**

- \$2,000 Red Rocks Community College Scholarship
- \$150 worth of techie items

#### **2<sup>nd</sup> Place**

- \$1,500 Red Rocks Community College Scholarship
- \$150 worth of techie items

#### **3<sup>rd</sup> Place**

- Free three credit Red Rocks Community College class



- \$150 worth of techie items

#### References

[1] "Urban Infrastructure Solutions | Sustainable Healthy Cities." *Sustainable Research Network*. N.p., n.d. Web. 13 July 2017.