2018 PepsiCo/Society of Women Engineers
STUDENT ENGINEERING CHALLENGE

"Bring together what is good for business with what is good for the world." *– Indra Nooyi, PepsiCo Chairman and Chief Executive Officer*

"We are in the business of discovery, but discovery is not about what you discover in the lab. Discovery is about wherever the idea comes from; embrace it! That is discovery. Look inside, outside, in developing markets or emerging markets." *– Dr. Mehmood Khan, PepsiCo Vice Chairman, and Chief Scientific Officer, Global Research and Development at PepsiCo*

Who We Are

PepsiCo products are enjoyed by consumers one billion times a day in more than 200 countries and territories around the world. PepsiCo generated more than $63 billion in net revenue in 2017, driven by a complementary food and beverage portfolio that includes Frito-Lay, Gatorade, Pepsi-Cola, Quaker and Tropicana. PepsiCo's product portfolio includes a wide range of enjoyable foods and beverages, including 22 brands that generate more than $1 billion each in estimated annual retail sales.

At the heart of PepsiCo is Performance with Purpose – our fundamental belief that the success of our company is inextricably linked to the sustainability of the world around. We believe that continuously improving the products we sell, operating responsibly to protect our planet and empowering people around the world is what enables PepsiCo to run a successful global company that creates long-term value for society and our shareholders.

Challenge Statement

In the tradition of the PepsiCo/SWE Engineering Challenge, we are calling for your innovative ideas and technical solutions. For this year's program, you will have the opportunity to respond to a challenge stemming from one of the following PepsiCo equipment categories: **Fountain Sensors**, **New Age Hydration** and **Cooler Design**. Please find a summary about each category and the associated challenge statement below for your review. To participate, please ***choose one*** *category challenge* to which to respond.

1. Sensors

In the foodservice business, PepsiCo provides syrup to our customers (e.g. restaurants) for fountain dispensing machines which is then mixed with water, and carbon dioxide for carbonated soft drinks, to produce a finished beverage as it is poured into a consumer's cup. Syrup is typically delivered to our customers in a 5 gallon, specially designed bladder housed in a cardboard box known as a bag-in-box, BiB.

BiBs are usually stored in a separate area from where the fountain machines is located; typically a storage closet or store room and has affectionately become known as the "backroom." BiBs are situated on racks or shelving and connected to the fountain machines via tubing, sometimes using up to 100 ft of tubing length to connect the two. Syrup is pumped from each individual BiB to the fountain machine with the use of a dedicated CO2 actuated pump. Currently, a low tech solution is used for when a BiB runs empty; the operators only become aware when consumers or employees report the fountain machine sputtering and only dispensing water. In the past, sensing systems have been developed to provide an alert to the operator when a BiB is empty but these systems have been unreliable to fully met the industry's needs (e.g. pressure or vacuum switches, software listening to the CO2 pump).

Challenge:

Design and develop a means to enable a bag-in-box system to know when the BiB is empty or near-empty and send an alert to be replaced. Areas to consider when developing your system are (but should not be limited to):

- The principle of sensing when the BiB is empty or near-empty
- How a "BiB empty" message will be communicated out
- Reset functionality upon replacement of BiB
- Where the solution will live (e.g. in/on individual BiBs or with the permanent pumping hardware)
- Cost and infrastructure of implementation

2. New Age Hydration

PepsiCo is committed to decreasing our products' impact on the environment, highlighted in our Performance with Purpose 2025 goals, with an ideal end goal of a zero net impact. One area of significant interest to PepsiCo is the number of PET bottles that are used to deliver our products to the consumer. Because these bottles have limited use after the product has been consumed and recycle rates tend to be low, PepsiCo is interested in options to eliminate the PET bottle all together and deliver products "beyond the bottle." Additionally, since consumer preferences have shifted towards zero calorie and healthier beverage products with water becoming their "go to" choice, we want to know what "water beyond the bottle" looks like.

Challenge:

If PET and single use containers were banned tomorrow on college campuses, how would PepsiCo sell Aquafina and LifeWTR branded water to students at school? Consider what

“water outside the bottle” means to you and how you might dispense to consumers in the college and university setting. Areas for consideration (but should not be limited to):

- Look and feel of a water fountain dispenser (e.g. design, color, user experience)
- Types of water to be offered and reasoning (e.g. still, sparkling, chilled, hot, filtered, alkaline, flavored)
- Dispense vessel (e.g. bring your own, connected bottle, PepsiCo branded bottle)
- Means of payment (e.g. cashless, subscription, meal plan)
- Best and worst placement locations on campus
- Features (e.g. hydration profile, consumption tracking, additives such as flavors or electrolytes)
- Connection to PepsiCo and it’s brands

3. Cooler Design

PepsiCo is committed to environmental sustainability as stated in our 2025 Performance with Purpose agenda. To help achieve this goal, PepsiCo is looking to rethink how we build and recycle coolers. Currently, polyurethane (PU) foam is used for structural support and insulation but presents a significant number of challenges. The process of manufacturing a cooler requires high capital costs for the foam injection equipment which limits the number of original equipment manufacturers (OEMs). Furthermore, economies of scale cannot be leveraged because the manufacturing process is specific to each individual foam fitting and multiple pieces of foam are not assembled together to build out a family of sizes. This leads to no standard sizes of coolers in the industry leading to many different SKUs at low production volumes. Other issues that arise in manufacturing include long foam curing times and the formation of cavity voids which affects the heat transfer performance and degrades the structural integrity.

For cooler end of life, the recycle process is time consuming and costly requiring a cooler to be shredded and the materials separated (i.e. metal and plastic). The PU is then ground into powder and heated to vaporize and remove adhesive so the PU can be reused in new commodities.

Challenge:

Consider the current way in which a cooler is manufactured and recycled. How might new processes and materials eliminate these bottlenecks to build a more sustainable cooler? Areas for consideration (but should not be limited to):

- Size and capacity parity to current coolers
- Similar mechanical strength and structural integrity as current coolers, see ASTM D642, ASTM D880, ASTM D6179, ASTM D5276 for stacking, impact and drop test guidelines.
- Cost parity to current coolers (e.g. a supermarket checkout lane glass door cooler is 10 cubic feet and has a cabinet cost (i.e. materials and manufacturing) of approximately $200; examples True GDM 10-HC, IDW CD10-HC)
- Thermal performance that meets Department of Energy 2017 cooler guidelines (i.e. vertical glass door cooler energy limit (kWh for 24hr) = 0.1*V+0.86, where V is the

volume in cubic feet). See www.gpo.gov/fdsys/pkg/FR-2014-03-28/pdf/2014-05082.pdf

Challenge Requirements

For an impactful proposal, please consider the items noted below and see the Terms and Conditions document for the grading rubric.

1. Identify technologies and technical solutions for the challenge statement/category you chose.
2. Do your research and be creative!
3. Provide details around how feasibly your solution could be executed in terms of the following, but not limited to:
    1) **Cost of implementation**
    2) **Scale (size of impact)**
    3) **Time required to implement the technology**
    4) **Resources required**
4. Provide details on the projected outcome or impact that your innovation would have on PepsiCo's business and/or our customers and consumers.
5. Be sure to read the guidelines for submissions in the Terms and Conditions section of our website at http://PepsicoStudentChallenge.swe.org/

References

1. PepsiCo's Performance with Purpose 2025 Agenda: http://www.pepsico.com/purpose/performance-with-purpose/our-goals
2. PepsiCo Global R&D College: Fountain Equipment Principles of Operation (exert), 2018.