**Engineering and the Design Challenge**

Typically, engineers take a Design Course as a capstone course: the culmination of four years of engineering technology education with students bringing together their technical and non-technical knowledge to complete a design project.

Important topics in the design process include:

* team dynamics
* effective oral and written communication
* spatial visualization
* problem solving

You experienced a taste of a design challenge during your team work on the Cranfield Carbon Storage Project. Team dynamics, spatial visualization, and problem-solving skills were all in use as part of that project.

PSTI Design Challenge

The PSTI design project today provides another opportunity to engage with engineering design and the fundamental skill-sets used in the design process.

The design project today will provide you with an opportunity to:

* practice skills working in a team setting
* apply knowledge learned during the PSTI to a specific project challenge
* analyze and synthesize to solve an open-ended problem
* consider the economic, environmental, and social impacts of your project design
* communicate effectively about the project’s specifications
* justify your proposed solution through supporting information and knowledge gained from the PSTI

An important learning outcome is the realization that engineering design is not accidental, but a controlled and structured process that yields higher quality solutions.

**I. Knowledge Gain** (8:15-9:00am)

This morning you will have an opportunity for both groups to gain some important knowledge and facility with energy concepts, terms, and numbers. Everyone should familiarize themselves with the material in the first lesson of the course, Energize the Future. There will be 5 topic pages to read.

**(A) and (B) Course: *Energize the Future*** (# of topics)

Lessons:

* What is Energy? (5)
  + How Do We Define and Measure Energy?
  + Primary Versus Secondary Energy
  + More On Power
  + Energy Implications for Standard of Living
  + Energy Implications for the Environment

**II. Kinesthetic Re-enforcement of Concepts** (9:00-10:15am)

Dr. Jon Olson will lead you through a process to better solidify some of our energy concepts.

**III. Break into Groups** (10:15am)

**Design Challenge A:** Energize the Future (far side of the room) Remain in the Brons Rm

<https://courses.energyexcursions.com/courses/energize-the-future>  
Design Challenge: Filling the Power Gap

Mentor:   
Dr. Paul Bommer, Hildebrand Dept. of Petroleum & Geosystems Engineering,   
The University of Texas at Austin

**Design Challenge B:** How Much Water Does it Take? (entry door side of the room) Move to Chairman’s Conference Rm (next door)

<https://courses.energyexcursions.com/courses/how-much-water-does-it-take>   
Design Challenge: Powering Texas

Mentor:   
Dr. Bridget Scanlon, Bureau of Economic Geology   
The University of Texas at Austin

**IV. Study and Discussion** (10:15-11:30am)

You might consider creating experts by ‘jigsawing’ your knowledge acquisition.

1. **Course: *Energize the Future*** (# of topics) (Brons Rm)

Lessons:

* Energizing Our Planet (3 topics)
  + Global Primary Energy
  + Global Modern Renewables
  + Global Fossil Fuels
* The Business Case For Oil and Gas (5 topics)
  + Oil and Gas
  + Global Political Tensions and the Impacts to Oil and Gas Economics
  + Climate Change Concerns and the Impacts to Oil and Gas Economics
  + The Electric Future
  + Meeting Electricity Demand

Preview the Lesson to prepare for your design work in Session VI:

* **Design Challenge: Filling the Power Gap** (6 topics)
  + Energy Revolution
  + Could Natural Gas Fill the Gap?
  + Could Nuclear Fill the Gap?
  + Could Wind Fill the Gap?
  + Could Solar Fill the Gap?
  + Creating Your Own Power Mix

1. **Course: *How Much Water Does It Take?*** (# of topics) (Chair’s Rm)

Lessons:

* The Texas Climate (4 topics)
  + The Köppen Climate Classification
  + Temperate Climate Types of Texas
  + Dry Climate Types of Texas
  + How Could the Texas Landscape and Climate Likely Change Over Time?
* Texas Water Resources and Usage (3 topics)
  + The Global Water Cycle and Water Resources in Texas
  + Texas Water Footprint
  + Is Texas Running Out of Water?
* Water-Energy Nexus (5 topics)
  + Why is the Water-Energy Nexus Important?
  + Water-Energy Nexus in Texas
  + How has Energy Changed in Texas Over Time?
  + Environmental Considerations for the Water-Energy Nexus
  + Planet Texas 2050, The University of Texas at Austin

Preview the Lesson to prepare for your design work in Session VI:

* **Design Challenge: Powering Texas** (3 topics)
  + Water and Electricity
  + How Much Water Powers Texas?
  + How Much Water to Power Texas in the Future?

**V. Design Challenge Insights from Experts**   
(11:30am-12:30pm and 1:00-2:00pm) Both presentations in the Brons Rm

During these two blocks of time you will hear from experts with important information on both of the challenges. (Lunch will be a break between the two presentations.)

Dr. Paul Bommer, Hildebrand Dept. of Petroleum & Geosystems Engineering,   
The University of Texas at Austin

Dr. Bridget Scanlon, Bureau of Economic Geology   
The University of Texas at Austin

This is your opportunity to ask them questions that may be related to your design topic.

**VI. Design Project Work** (2:00-3:15pm)

**Group A** works together on Design Project (see Section IV) and Presentation(Brons Rm)

**Group B** works together on Design Project (see Section IV) and Presentation (Chair’s Rm)

You will work on a Google Sheet linked to in your Design Challenge to summarize your design. You will want to include that information in your presentation. Think about how you will showcase some of the aspects of a good design project mentioned earlier.

* practice skills working in a team setting
* apply knowledge learned during the PSTI to a specific project challenge
* analyze and synthesize to solve an open-ended problem
* consider the economic, environmental, and social impacts of your project design
* communicate effectively about the project’s specifications
* justify your proposed solution through supporting information and knowledge gained from the PSTI

**Your PPT presentation:** 15 minutes in length; Several people can participate in the actual presentation of your work. You will put this on a stick to put on the main computer in the Brons Room.

**VII. Design Project Presentations and Feedback** (3:15-4:15pm) Brons Rm

Moderator: Kathy Ellins, The University of Texas at Austin