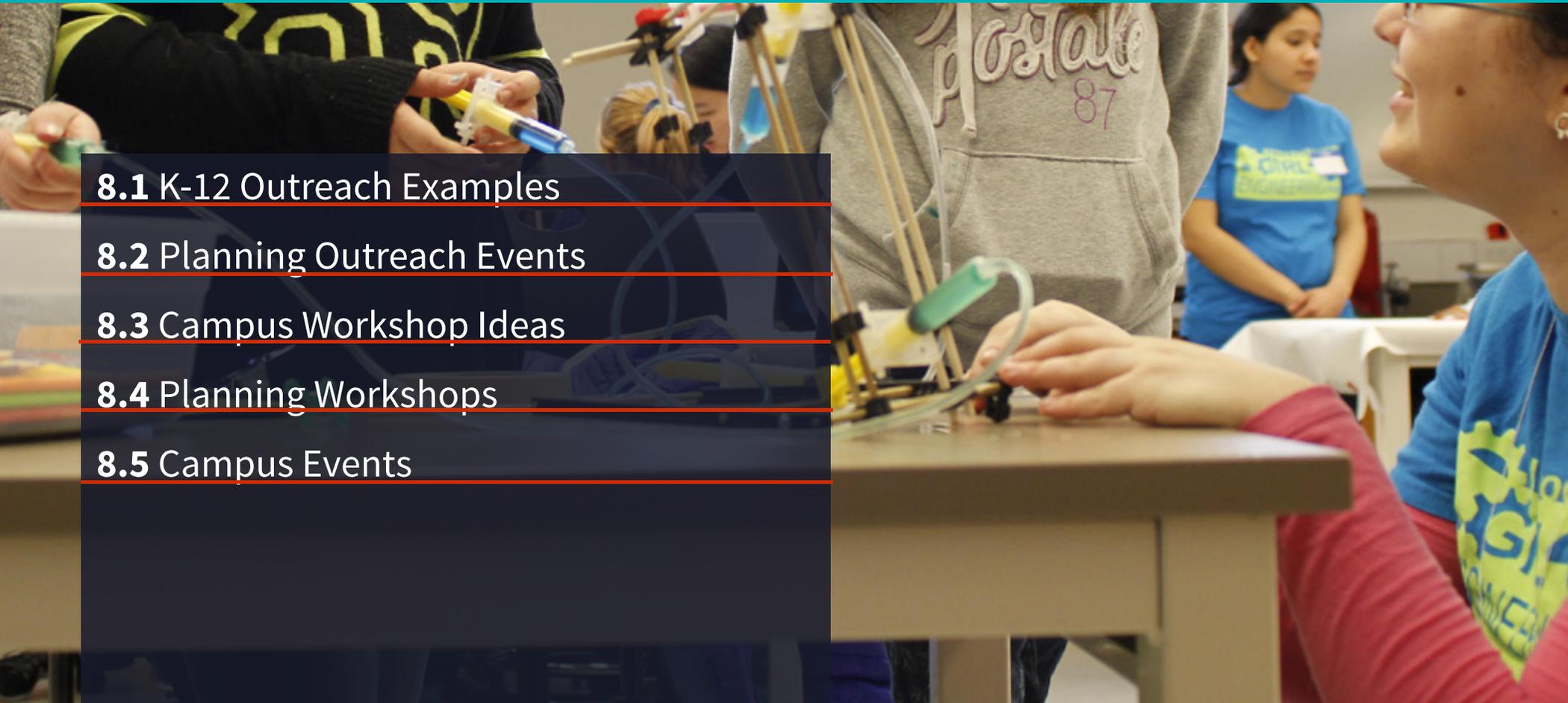




8.0 Educate

K-12 Outreach & Campus Initiatives



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8.1 K-12 Outreach Examples

Education is near and dear to ESW, with one third of our tagline (design educate build) dedicated to it. Practically everything you do as a member of an ESW chapter goes back to education. All your project experience is giving you a hands-on engineering education. But there are other ways to incorporate education in your chapter. We primarily divide education initiatives into two categories: K-12 and student based. On one hand you have K-12 educational outreach. This could include working with local school teachers, hosting kids on campus, or volunteering at a science fair. On the other you have educational initiatives aimed at your peers. A great way to engage in this is to develop and host workshops.

You can learn more about workshops and educational outreach in this chapter. We present excellent examples of educational work done by chapters to get you inspired and then provide some tips for replicating these



While educational outreach is not a vital component of ESW, it is something that is near and dear to a lot of chapters. Educational outreach can help inspire the next generation of sustainable engineers, just like ESW is doing for undergraduate engineering students. Outreach helps to show what engineering really is (and everyone has their own definition of engineering). You can get kids excited about sustainability and get them asking questions about sustainability in their own life and community. It is also just a great way to give back to your community. And finally, it provides

leadership experience for your members.

To get you inspired, here are some of the educational outreach events ESW chapters have hosted.

Explore UT

ESW UT Austin

ExploreUT is an annual all-campus event at the University of Texas in Austin that invites kids of grades K-12 to come explore educational activities hosted by campus organizations. In the past, ESW-UT has set up a booth and let children build their choice of a solar, wind, or rubber-band car.



ESW-UT Austin during their Explore UT outreach event.

8.1 K-12 Outreach Examples



A Closer Look at Introduce a Girl to Engineering Day

Mechanical Activity

Instructions are so overrated. So for this activity girls were given the pieces of an advanced hydraulic arm kit and were given one simple task: get the arm to work! They went through a rapid iterative process to get their ideas to work.

Civil Activity

AutoCAD is an essential software for civil engineers, so girls were tasked with designing a house for a real life client. After mocking up the house in CAD, they laser printed their pieces on chipboard.

Electrical Activity

Escaping from Mars was the main challenge here. Girls built a LEGO Mindstorm robot and then programmed it to navigate Mars.

Before the kids arrived, the members created a fake land of destruction and placed Lego men in the midst of the destruction. The goal of the activity was for the kids to create a sustainable structure that would save the Lego men from the destruction. Around 200 kids visited ESW-UT's booth!

Girl Day

ESW-Smith

Every year as part of eWeek, Smith College joins dozens of other colleges in hosting Girl Day, an outreach event aimed at getting middle school girls interested in engineering. Student volunteers designed activities that covered electrical, civil, and mechanical disciplines of engineering. During their 2014 event, 135 girls were tasked with one of three design challenges: to program a LEGO Mindstorm robot to escape off Mars, design a laser-printed chipboard house for a real life client, or construct an hydraulic arm.

Students Sustainability Outreach Day (SSOD)

ESW-UCSD

ESW-UCSD held a variety of workshops and activities throughout the day, all touching upon some aspect of sustainability, in an effort to motivate young high school students to lead more sustainable lives and pursue higher education.

To name a few, ESW hosted a wind turbine workshop where the students worked in groups alongside an ESW member to construct a wind turbine model. Students were able to see first hand how wind energy could be harvested to power something--in this case, an LED light.

Other activities throughout the day consisted of a gardening workshop where the students planted and got to keep drought-resistant plants and a college student panel where the students asked questions about what it means to be sustainable and the general college experience.

8.2 Planning Outreach Events

Planning an outreach event isn't so much a linear process. Event planning is messy and the amount of work involved depends on the size of your event. However, there are a few ubiquitous tips we can provide.

If you are thinking of planning an outreach event but don't know where to start, there are few methods to get the ball rolling. You can get in contact with any faculty that are engaged in educational outreach to see if there are any opportunities for ESW members to get involved. You can see if there are any teachers in the area that would be willing to let ESW members facilitate an activity in their classroom. Finally, always, be on the lookout for cool STEM events in the area, they always need volunteers

Working with kids can be tricky. Not only is there a certain liability issue in working with kids, they can be quite the handful. If you are inviting kids to your college campus, first, get in contact with the appropriate office or faculty member to see how the college handles having kid on campus.

Check with your college to see if you need photo release waivers and liability waivers. If you are working with kids off campus, check in with the organization concerning their rules and tips for working with children

As a last piece of advice, it is generally a good idea to train your volunteers before unleashing them into a room with a bunch of children. Half of the training deals with ensuring your volunteers have the technical knowledge to facilitate the activity.

The best way to do this is to have every volunteer do the activity themselves. This is tricky if you have not budgeted in the materials. The other half of training concerns how to best work with kids. Educational outreach is much different from tutoring. Outreach is not the time to show off how much you know about wind turbines, it's a place for you to facilitate the learning process.

Volunteers should be instructed to encourage kids, especially if they are struggling. Volunteers should never just do the project

for the kid. Rather the volunteer should help answer questions and guide the kid through the engineering design process.

In addition to the above advice, here is a general hodgepodge of tasks that may or may not factor into your event planning process.

Logistics

- Estimating the number of attendees
- Scoping out rooms
- Reserving rooms
- Coordinating meetings
- Working with on-campus offices and faculty members
- Getting food for the event
- Organizing for transportation

Activities

- Brainstorming potential activities
- Developing activities
- Selecting activity leaders
- Preparing activity materials
- Creating activity instructions, presentations, etc.

Student Volunteers

- Recruiting volunteers
- Developing a training
- Getting volunteer t-shirts

- Creating a volunteer goodie bag

Budget

- Create an initial budget
- Contact companies about potential event sponsorship
- Applying to grants
- Submitting budget
- Buying materials

Recruitment & Registration

- Developing a social media presence
- Working with local nonprofits to advertise the event
- Creating and distributing flyers
- Creating a registration system
- Translating registration materials into Spanish or other languages
- Contacting schools about advertising the event

While this is only a coarse grain look at the tasks involved in planning a large outreach event, it should provide you with some food for thought. We hope this sets you out on the right foot for all your future K-12 outreach initiatives!

8.3 Campus Workshop Ideas

Outreach is good for the kids, but what about college students? Educating your peers is a huge component of ESW. ESW mostly does sustainability education through projects, but they require a large time commitment. What if I told you there was a way to educate students on sustainability and engineering and keep the time commitment to under two hours? Workshops, hosted by ESW members, are the perfect way to accomplish all of the above and more--workshops also provide a social space for your community to bond and a way of recruiting new members.

A workshop can take on many forms, but when we use the phrase workshop we mean a 1-2 hour interactive, hands-on event aimed at either building a physical thing or developing a skill.

ESW has developed a series of Build-A-Thing workshops. We have created all the materials you need in order to host one of these workshops at your chapter. The next section presents an overview of a few of these workshops to get you inspired.

Technical Workshops

Solar Cell Phone Charger

In this workshop, participants build their own personal solar powered cell phone charger using just a few parts. Participants will learn the basics of solar panels, how to solder, and brainstorm how to improve the design.

Upcycle a wine bottle

Drinking is commonplace in college, but what do you do with all your empty bottles? This workshop teaches you how to upscale your empty wine bottles into small plant holders.

Arduino Sensor Series

This three part series introduces students to how Arduino can be used to create sustainable devices. To help fund the workshops, you can ask students to pay when they sign up. The same Arduino board is used for all three workshops to save money, so students should attend all three workshops and then pick which device they like the best. Students first build a light sensor that turns off a lamp in the daylight. The second project entails a low-tech water usage monitor. Finally, students will de-

sign a low-cost air quality sensor.

Soft-Skills & Other Workshops

How to talk to a climate skeptic, ESW-Pitt

Pitt's student climate expert led a workshop to prepare students for battling with climate deniers, with a focus on half "climate science 101" and half "science communication 101". Some of the goals of the workshop included understanding the science of climate change, find ways to communicate science to different audience, prepare for common myths and rebuttals, and discuss why we should even care in the first place.

LCA Workshop, ESW-Pitt

Inspired by an event conducted by a professional at their school, ESW-Pitt decided to develop and host their own workshop to educate students about Life Cycle Assessments (LCAs).



We here are ESW believe that workshops are one of the best ways to educate your peers about sustainability, so we have gone ahead and done the hard work for you! ESW's Build-A-Thing Workshops are a set of developed activities on our website available for download! Each workshop comes with a:

- lesson plan
- bill of materials
- presentation
- instructions
- discussion guide

We are currently piloting a solar cell phone charger and a wine bottle planter workshop. You can access these materials [here!](#)

8.4 Planning Workshops

Developing a workshop from scratch is very rewarding, but it involves a certain amount of insight and skill. You can not just throw people into a room, mix them with some materials, and say, “have at it!”. Facilitating a workshop is a bit like being a teacher. You need a lesson plan, an agenda, a powerpoint, and a handout at the very least. Below we present examples of workshop lesson plans--one for a technical skills workshop and one for developing soft skills.

Technical Workshops

One of the challenges with the technical, hands-on workshops is to balance “making a thing” with “engineering.” Following a bunch of steps to create a product is great, but it is not necessarily engineering. On the other hand, you can not fit the entire engineering design process into a one hour workshop--that is what we have projects for. Here we present a format for facilitating an educational and fun technical workshop. We will use the solar cell phone charger workshop from ESW’s Build-A-Thing series as an example.

The goals for the workshop are:

- Build** a solar powered USB charger
- Learn** technical and practical skills
- Practice** the engineering design process

The workshop followed the format below:

- 1. Introduction.** As usual, introduce yourself and the goals for the workshop. Pretty simple.
- 2. Pre-Survey.** Pass out a pre-survey to gauge the competency and skill in the room. These metrics are purely to help you gauge the effectiveness of the workshop, as you will do a post-survey. In this case, the pre-survey asked about experience with soldering, whether the person had heard of ESW before, and how comfortable they were with DIY projects.
- 3. Safety.** Before you jump in to the good stuff, a quick overview of safety is important. In this case, a soldering 101 was given. Some workshops do not have a safety component, but it is always better

to stretch your imagination and find something safety-wise to mention before diving into the activity. For the solar cell phone charger workshop, we ask facilitators to give a quick overview of the hazards of soldering.

4. Build-A-Thing. And now the good stuff. Pass out the handout/instructions, make sure everyone has the materials they need, and let them have at it. You can have a powerpoint with a walk-through of the instructions, but you should also encourage people to go at their own pace.

5. Test the prototype. In this case, everyone brought the solar charger outside and tested the voltage with a Voltmeter to ensure that the prototype would carry a charge. Attendees could then plug in their phones to ensure that their device could register a charge. If a prototype did not work, attendees could go back inside and try to fix their issue if enough time is allocated. If there is not enough time, attendees could troubleshoot their problem with the facilitator and then apply the fix on their own time.

6. Discussion. Because these workshops are a place to learn in addition to making, we highly encourage incorporating a discussion segment into the workshop. This is the perfect opportunity to have conversations about the intersection of sustainability and engineering. In the case of the solar charger, how could it be more portable? How could it accommodate different electronics? Have attendees brainstorm on whiteboards, post-it notes, on paper. Encourage them to test out their ideas outside of the workshop.

7. Post-survey. Before everyone leaves your workshop, make sure they fill out the post-survey. This is to assess how well your workshop was in educating people and to help you plan the next one. Some questions asked for this workshop include how comfortable students felt working with a soldering iron afterwards, how likely they were to attempt a DIY project, and what workshop they would want to see in the future.

8.4 Planning Workshops

Soft Skills Workshop

The ideal soft skills workshop should strive for a balance of lecture, discussion, and interaction. Getting those three components adjusted just right takes a lot of drafting. If you were to just stand at the front of a classroom and read off a PowerPoint, well, you would be giving a lecture, not a workshop. A bunch of people chatting in a room is not really a workshop either, though it is fun. A good workshop will find a way to combine these aspects into one educational format. To give you something to work off of, we

Paired Listening

Paired Listening is an icebreaker/facilitation technique where pairs of attendees must take turns responding to the facilitator's question. The twist is that while one person talks, the other person must remain completely silent. They are supposed to maintain eye contact and can only nod their head in agreement! The activity encourages people to talk without being interrupted!

present an example of a leadership workshop conducted at an ESW Annual Conference.

The following is the agenda for a workshop titled Leadership Beyond Delegation with the goals of: Inspire and motivate leaders to implement leadership practices that promote the formation of high performance teams (HPT) Provide specific actions leaders can take to engage members Allow for attendees to brainstorm solutions to engagement problems

The workshop followed the format below:

- 1. Pre Workshop Shenanigans.** Before getting into the meat of the workshop, the facilitator had to take care a few items of business. Introductions were handled, an overview of the workshop was presented, and the facilitator stated the goals of the workshop.
- 2. Icebreaker & Intro.** A “paired listening” icebreaker was used to get people talking and active. The icebreaker was used as a springboard to begin a conversa-

tion about the workshop topic. Attendees called out themes from their conversations, which were collected on a white board. This list of themes about leadership was then used to launch into an introduction of the purpose of the workshop.

3. Small Group Work. Several leadership strategies were presented in the workshop. Each strategy was discussed in three components. First, the facilitator discussed the general theory behind the strategy. Then the leadership strategy was related to ESW through concrete examples. Finally, to make the workshop more interactive, the attendees worked together in small groups to discuss a posed question. The attendees were given five minutes to discuss in groups of 4-6 topics like why they are passionate about ESW, what is their secret superpower, and what they are most proud about their ESW chapter. In the workshop reviews, this discussion time was viewed as critical to the learning experience.

4. Brainstorming. If you plan everything right, there will be enough time for an informal question and answer section of your workshop. In the Leadership Beyond Delegation workshop, the facilitator asked attendees to call out issues in the chapters that they wanted to discuss in small groups. A list of six questions were developed to delve out to the six small groups. The groups were given 5 minutes to discuss strategies for overcoming these issues. Then each group presented their discussion to the larger group, and their words were captured in notes.

5. Conclusion & Evaluation. It is necessary to bring everyone back together and present once again the goals of the workshop. As English professors often preach, you need to tell them what you told them. Make sure everyone leaves knowing that they (hopefully) got out of the workshop. If you are interested in learning how to improve your workshop, pass out index cards. Ask attendees to write one thing they like on one side and one thing they would change on the other.

8.4 Planning Workshops

The above was just one way of creating a workshop, but if you wanted to create a workshop from scratch, we have tips for that too. The following is one process for developing your very own workshop.

1. Start with some goals. Before you do anything else, start by figuring out what you want people to take away from your workshop. Ask yourself what you want people to say they learned from your workshop. Is it to learn how to use a piece of software? Is it to learn how solar panels work? Is it to brainstorm solutions to a problem? Once you establish the goals for your workshop, the planning process becomes a lot easier.

2. Do your research. You may know a lot about the subject of your workshop, but it never hurts to learn more. You can start by writing out everything you know and build the framework of your workshop. Identify gaps in knowledge and seek out information by reading books, finding web articles, and bothering your grad school friends and professors.

3. Create an agenda. This cannot be stressed enough. Start with an agenda. Use the example formats from above as a starting place, then tweak them to your liking.

4. Determine what resources you need. While the agenda is a universal component of practically any event or meeting, the other materials needed are not always so obvious. What will the attendees need in order to complete the activity? Instruction handouts are commonly used, as are powerpoint presentations.

4. Create resources. After you have created your agenda, then you can begin creating your additional materials. Make a powerpoint to communicate your ideas, but do not just copy your agenda into your power point. Think about what handouts or instructions attendees might need. Maybe you want your attendees to read a quick article to get a conversation flowing.

Ideation

Planning a workshop is a fairly straightforward process. But getting to that point is half the battle! Coming up with an idea for a workshop is no easy feat. How can you make a workshop that will teach people both about sustainability *and* engineering? Here we will take some time to explain some methods for generation ideas.

Starting from Scratch

If you want to start from the very beginning and create your own totally unique workshop, there are a few things to get your brain in gear. As shown in the image on the left, you can engage in a brain dump. All you need is a pen and some paper. Start by writing out some categories. For our purposes, starting with different areas of sustainability is useful. The main ones are transportation, water, energy, food, cities, and buildings. From there you can start writing out any idea that pops into your head, no matter or “bad” or strange. Brain-



map format to link like ideas, draw connections, or branch off from existing ideas.

Once you have a well marked up piece of paper, you can go through and star promising ideas. Maybe one idea will send you into another brainstorming frenzy. Maybe you came up with an idea you really want to flesh out. Either way, you have a lot of starting points!

8.5 Campus Events

Apart from workshops, there are less time-intensive, planning-intensive events you can host to educate your campus about sustainability. We have a bunch of examples to share with you!

GreenTube

ESW-Smith

Every few weeks ESW-Smith invites students to convene for friendly discussion about a topical sustainability issue. The President usually facilitates the discussion and comes prepared

with a short presentation and some follow-up questions. Topics in the past have included discussing the August 2015 Clean Power Plan Act, a large on-campus lecture about climate change, the People's Climate March, and a video critiquing the definition of sustainability.

Documentary Showing

ESW-UC Denver

A couple years ago, UCDenver did a showing of Chasing Ice, a documentary about James Balog

and his quest to photograph climate change. After the film the chapter had Adam LeWinter, chief engineer featured in the film who working on setting up and weatherproofing the time lapse cameras stationed for months at a time, come and a talk about his experiences with filming, engineering in the cold, how the project has changed his life, and witnessing a chunk of ice the size of lower Manhattan fall off of a glacier.

Speaker Series

ESW-Cornell

In 2014 ESW-Cornell hosted two guest lecturers in the fall semester. They invited Bruce Abbott of Abbott Lund-Hansen, a combined heat and power firm, and Marguerite Wells of the Black Oak Wind Farm Project, a company that aims to provide wind power to New York.

The speaker series was a great way to let ESW members network with professionals!



Food Week

ESW-UT

Stemming from the annual Food Day event at UT-Austin, ESW-UT created Food Week in collaboration with other orgs. The week encompasses a variety of events aimed at educating college peers about food and agriculture. Events included a workshops on how to cook and eat with local ingredients, eat healthily, and cook based on the season.

8.5 Campus Events



Hydroponics Workshop

ESW-Smith

During January, ESW-Smith took advantage of an opportunity that lets students propose and teach their own classes. Members developed a five day course to teach non-engineering majors, students and adults alike, about the design process through the design and build of a personal hydroponics system. Attendees brought 2L bottles which were re-purposed into plant holders for the hydroponics systems. The attendees were then challenged with improving their design beyond the course.

Seminars

Invite university professors, graduate students, speakers from non-governmental organizations, returned ESW overseas volunteers, or experts in a field that relates to ESW to give a talk.

Discussion Series

Many chapters choose to opt for a sustainability discussion series. It is an excellent way to incorporate the education aspect of ESW's mission into your chapter and develop a strong sense of community among your members. Ask board members to take turns presenting on a topic within sustainability and engineering. Engage your general body by having a "call for proposals" and letting them facilitate one of these meetings.

Project Fairs

Organize a poster session and/or presentations by groups doing work that is relevant to ESW. Advertise the event within your university and the surrounding community. On-campus project fairs during student orientations and parent visiting weekends can attract new students to your chapter

Guest Speaker Series

String together a series of lectures (formal or informal) and tie them into a series. You may consider having a common theme run through the lectures, or seek support from the university to provide course credit to students.

Panels

Invite several speakers who are experts in a given area to speak at your university and organize a panel in which these experts discuss or debate a certain subject. Prepare questions for the panelists beforehand and find a chairperson who is knowledgeable in the topic of discussion so that she/he can effectively moderate and guide the panel.

Movie Nights

Get together to watch a movie related to sustainability and/or development & technology. Hold a discussion afterwards. Some possible films include Baraka; Empty Oceans, Empty Nets; Save Our Lands, Save Our Towns; An Inconvenient Truth.