

MECH425 AT Project

To contribute to Applied Sustainable Development

Introduction:

Open source appropriate technology (OSAT) refers to technologies that provide for sustainable development while being designed in the same fashion as free and open source software.¹ Facilitated by advances in information technology software and hardware, new ways to disseminate information such as wikis and Internet enabled mobile phones, the global development of OSAT has emerged as a reality.

As you know from our work with the Green IT project, Appropedia.org is the site for collaborative solutions in sustainability, poverty reduction and international development. It is a wiki that shares information about appropriate technologies for the entire world for free. **These technologies must be practical – they must be either affordable or able to be easily and economically constructed from readily available materials by local craftspeople** (e.g. stoves/ovens, compost bins, solar water purifiers, solar cookers, straw bale construction, biological waste treatment, rainwater catchments, metal kilns, passive solar devices, wind mills, micro-hydro, aquaculture, methane digesters, ferrocement, brick making, “chicken tractors”, basic water pumps, etc.).

This project will allow you to demonstrate the engineering skills you have honed in your time at Queen's to develop the AT of your choice as if it were a conventional engineering design and optimization project. You will publish your work on appropedia.org for the global community to utilize in an effort to improve sustainable development.

Motivation:

This project will provide you with an opportunity to participate in global collaboration to support sustainable development. Appropedia pages are being ported to the One Laptop Per Child (OLPC), <http://wiki.laptop.org/go/Home> formerly the famous “\$100 laptop” project. If your work is good – there is a very real chance it may get translated and used by millions of people all over the world. For those of you considering working in this area it is a opportunity to begin establishing your reputation and for those considering graduate school this project could also help build your resume and career.

Assignment:

Construct or fortify the information in Appropedia on an appropriate technology of your choice.

- A. Identify an appropriate technology that interests you through research in the library, the examples from my former students, examples from class content, my own collection of books/articles, appropedia itself and the Internet. Your choice may already be covered by Appropedia, in which case you are expected to significantly enhance (details below) what is already there. For project ideas:
 - a. There are many incomplete topics already mentioned in Appropedia – Stubs are articles that have been started but need a lot of work: <http://www.appropedia.org/Category:Stubs>

¹ Joshua M. Pearce and Usman Mushtaq, “Overcoming Technical Constraints for Obtaining Sustainable Development with Open Source Appropriate Technology”, *Proceedings 2009 IEEE Toronto International Conference – Science and Technology for Humanity (TIC-STH)*, pp. 814-820.

- b. Appropedia's suggested projects
http://www.appropedia.org/Category:Suggested_projects
 - c. Any of the technology in the Appropriate Technology Library:
http://www.appropedia.org/AT_Sourcebook
 - d. For those good at CAD – consider joining http://www.appropedia.org/AT_CAD_Team and choose a complicated project to open source CAD
- B. Go to the MECH425 page in Appropedia and add your project in alphabetical order with your name and hyperlink it with [[]]. **First come – first serve.**
http://www.appropedia.org/Mech425_AT_Project
- a. Some of you may want to work on the same technology, which is alright as long as you work on different aspects. For example, the “photovoltaic” page already exists <http://www.appropedia.org/Photovoltaic> and is quite good, but you might use information in class to enhance one of the subcategories such as a new section on inverter and transformer design for photovoltaic applications, or a detailed explanation of optimal racking based on green design for a particular application. This should be created as a separate new page.
 - b. Research the technical specifications of the device paying very close attention to the engineering optimization. Be sure to follow the CC-BY-SA License – anything you post can be copied, modified, and redistributed so long as the new version grants the same freedoms to others and acknowledges the author of the Appropedia article used.
<http://www.appropedia.org/Appropedia:Copyright>
- X. **Write an Appropedia article (or several integrated articles) on your chosen AT.** (This is the part you will be graded on – **article due by April 9th by 9AM**).

If you choose a project that already has a stub like page in appropedia – copy all the wiki code from the main page to the discussion page and write in the comments what you have done. Then tag the main page with `{{425inprogress|May 1, 2010}}` to keep everyone from messing with your project. If there is already substantial information on your topic available – create a new page on the specific topic.

This is a chance for you to flex your engineering muscles. Normally AT is given very modest engineering attention – usually it is developed in the field via trial and error. There is enormous room for improvement.

Could treadle pumps be improved with solid FEA?

Could the standard water ram be improved with a CFD analysis?

Could a full thermodynamic analysis of a rocket stove increase its efficiency?

Could principles of fluid and structural mechanics lead to better water storage design?

What manufacturing techniques are available for the production of water turbines? Can they be applied in the village context?

What algorithm could lead to a better solar system design without the expensive software?

Can a good engineering design analysis reduce the weight and cost of the ambulance bicycle trailer?

<http://news.bbc.co.uk/2/hi/africa/8320781.stm>

Any AT are open for analysis from CFD on passive evaporative cooling, passive solar ventilation, and solar design of a house for a region's architectural style (awnings, passive ventilation, etc.), grain storage (taking into account ventilation and humidity control) and a full analysis of traditional brick forming kilns.

You may want to build your device to test it – this is a really good idea and you can post the results of your experiments on the page. If you can not afford to build it – then it is probably not AT in the developing world context.

Consider using the standard format below while realizing that your project may need more:

- 1). Title of the device or system
- 2). Abstract describing the function of the device or system
- 3). What engineering principle(s) underlie the function of the device – include equations and explanations of variables and design features.
- 4). Regional considerations such as climate, locating raw materials, etc, as well as cultural, social and political context.
- 5). Based on the developmental needs addressed (e.g. food, heat, electricity, clean water, health care, etc.) be sure to label your device in the proper categories e.g. use

[[Category:Food and Agriculture]]. Be sure to categorize your device so that it will be easy to find – for example “Low voltage connection basics” is categorized in [[Category:How tos]], [[Category:Electricity]], [[Category:Electric lighting]].

- 6). Materials needed for fabrication of device **and** alternative materials if they are not available
- 7). Tools needed for fabrication of the device **and** alternative tools if they are not available
- 8). Skills and knowledge necessary to make the device – link to relevant wikipedia or wikiversity articles/courses
- 9). Technical specifications including drawings or pictures of the device at minimum. Ideally full CAD files would be provided along with detailed fabrication instructions. You can scan any of your own drawings or schematics and paste them in your document. If you use pictures from other sources be sure to have proper permissions. You can upload files (e.g. pictures, images, etc.) here: <http://www.appropedia.org/Special:Upload> and then link back to them in your article
- 10). If it is a device design **be detailed enough in your “how to” to ensure that someone could construct the device from your description. Consider the elegance of IKEA like instructions.**
- 11). Estimated costs
- 12). You might also want to include common mistakes to avoid in building or using a technology and case studies you have found of a technology being used successfully.
- 13). The sources of information (e.g. engineering handbooks, journal articles, government documents, webpages, books, magazine articles etc.). References should use the <ref> </ref> and <references/> tags and can be in any format but should include all the information necessary for someone else to find the same information you did. For example:

web page: Department of Energy (DOE) Landscaping and Energy Efficiency, DOE/GO-10095 (1995) Available: www.eren.doe.gov/erec/factsheets/landscape.html [Accessed Date]

book: Innovations and Materials for Green Engineering Vol 3, eds. A. Lakhtakia and C.E. Bakis, Department of Engineering Science and Mechanics, PSU, June 2001.

journal article: Joshua Pearce, “Photovoltaics – A Path to Sustainable Futures”, *Futures* 34(7), 663-674, 2002.

Finally you will want to [[link]] to your article by in other Appropedia articles that mention your articles name and you may wish to put your article in a portal (e.g. <http://www.appropedia.org/Portal:Energy>)