



Florida Institute of Technology
High Tech with a Human Touch™

Co-development of Academic and Campus Sustainability at F.I.T.: A Campus Classroom Model



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Florida Institute of Technology

Dept. of Education & Interdisciplinary Studies

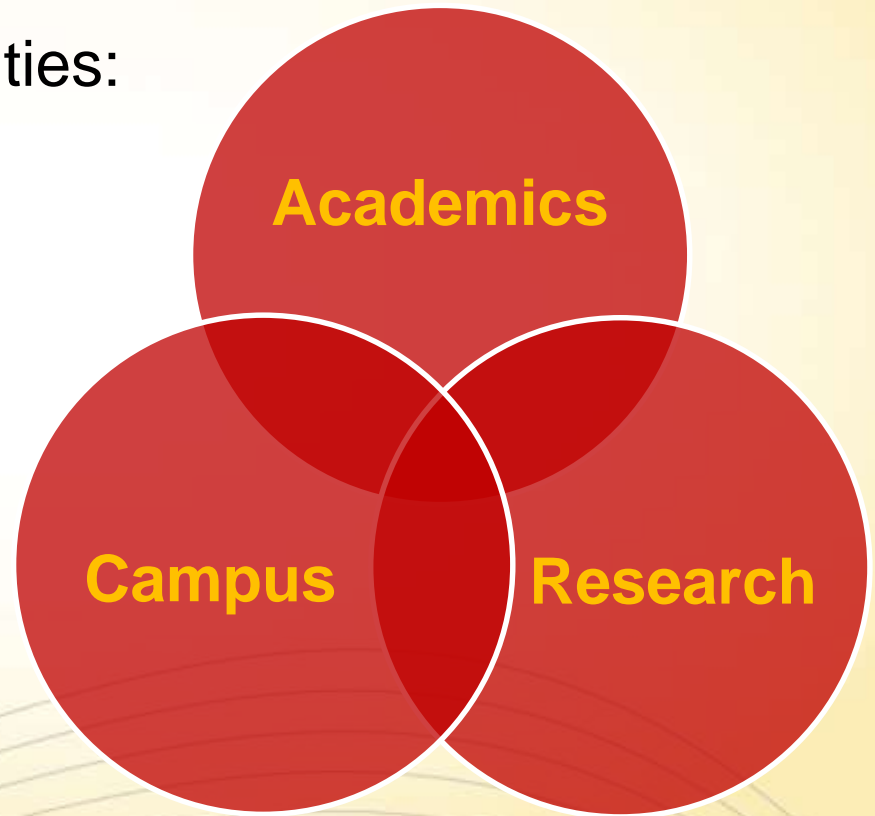


University Sustainability

Three components for universities:

Why university sustainability?

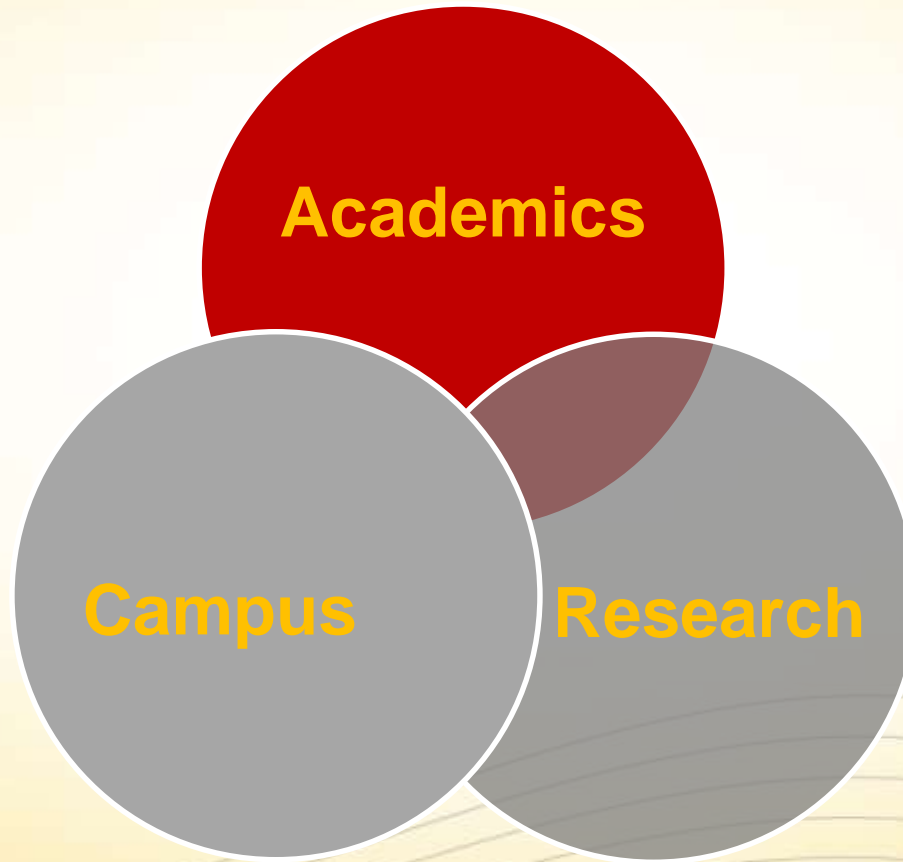
- Competitive advantages
 - Reduce expenses,
 - Increase revenues
- Desire to innovate
- Desire to improve society
- Student demand...





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University Sustainability:





ACADEMICS

Academics

[Home](#)[Student Sustainability
Research Guide](#)[Virtual Climate Adaptation
Library](#)[Dept. of Education &
Interdisciplinary Studies](#)[2011 Sustainability Forum](#)[Sustainability 2009 \(Book PDF\)](#)[Sustainability Home Page](#)

Related Major Programs

Applied Sustainability Education

Sustainability is one of the most important and marketable specialties available in the 21st century. Florida Tech offers multi-disciplinary sustainability education via a **Bachelor of Science in Sustainability Studies** and a program **Minor in Sustainability**. We use innovative courses, systems thinking skills, and applied projects to unravel the complexity and build real-world expertise in your areas of interest. Final projects use a campus classroom model: students address university sustainability challenges to develop marketable skills for diverse occupations. What over 750 global CEOs think: [future prospects in sustainability](#).

Bachelor of Science in Sustainability Studies

Florida Tech's major program in [Sustainability Studies](#) expands on our well-known science and engineering strengths and combines customized business and social science courses to produce graduates that can operate across multiple disciplines in the 21st century. Four concentrations are offered: *Technology & Engineering*; *Business & Economics*; *Environmental Sciences*; and *Social Sciences*. Student capstone projects required for the major and minor programs are helping to spear-head sustainability education initiatives [on-campus and around the Space Coast](#).

Program information is available in the [Major Planning and Elective Guide](#) and at [Sustainability Studies](#). The major planning and electives form is used to plan diverse electives within and among the four concentration areas. Please contact [Sustainability Education Program](#) for more information on any question. Over 50 job descriptions: [University Sustainability Professionals](#).

Undergraduate Minor in Sustainability

Florida Tech's Minor in Sustainability is available to undergraduates *from any College* - Science, Business, Engineering, Aviation, and Psychology/Liberal Arts. Since 2010, students from over 15 majors from all five colleges have taken advantage of this program. The minor consists of 6 courses (2 required, 4 elective) that total 18 credits. With planning, many students can integrate most courses into their sustainability education curriculum. Two courses are required for the

Program Information

- [Major: Planning and Electives](#)
- [Minor: Course Planning Form](#)
- [Minor: Electives List](#)
- [Registering: ISC 1500](#)
- [Bio-physical Thresholds](#)

[www..fit.edu/sustainability](http://www.fit.edu/sustainability)



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FIT Minor Program in Sustainability started in 2010.

Surprisingly, of almost 100 colleges & universities in Florida, <10 minor programs in sustainability.

35 students/yr from all 5 F.I.T. colleges and >15 different majors.

This is *three times more* than the second most popular minor on campus at FIT (of 25 minors total).



For the Minor, 18 credit hours are required (6 classes), 2 were new classes:

- *Introduction to Sustainability* - ISC 1500
- *Applied Sustainability* (project class) – ISC 4000

Students said that they came to FIT or stayed due to the minor.

Minor capstone projects have improved campus.

Success of the minor program triggered research into the possibility of a major program...



The Path to a New Degree: The Bachelor of Science in Sustainability Studies

We could not justify building a new Bachelor program in Sustainability Studies without demonstrating that there was:

- student demand for a major degree program
- a legitimate job and career market



Student Demand

- Though definitive numbers are unavailable, student interest is reflected in the increase in university bachelor's degree offerings, with >70 degrees now available in the U.S. – most since 2000.
- A survey of 16,000 college applicants and parents found that 66% expressed an interest in the college's sustainability efforts and *24% said such information would “very much” impact their decision to apply to or attend the school* (Princeton Review, 2011).
- Numerous national and regional newspaper articles report expanding student interest in sustainability curricula.

Bachelor of Science	Major Program Name	ST	College or School
Appalachian State Univ.	Sustain. Develop. – Agriculture	NC	University College
" " "	Sustain. Develop. - Comm. Dev	NC	University College
" " "	Sustain. Develop. - Env. Studies	NC	University College
Aquinas College	Sustainable Business	MI	Business
Arizona State Univ.	Sustainability	AZ	Sustainability
Catawba College	Sustainable Business	NC	Business
Clemson Univ.	Soils & Sustainable Crops	SC	Agricult. Forestry & Life Sci.
Eastern Mennonite Univ.	Environ Sustainability	VA	*
Ferris State Univ.	Architecture & Sustainability	MI	Architect & Landscape Archit
Furman College	Sustainability Science	SC	Sustainable Studies & Science
Hofstra Univ.	Sustainability Studies	NY	Sustainability Studies & Sci
Indiana Univ. - Purdue Univ.	Sustainable Manag & Policy	IN	Public Administration & Policy
Kean Univ.	Sustainable Science	NJ	Ctr for Sustainability Studies
Libscomb Univ.	Sustainable Practice	TN	Inst for Sustainable Practice
Maharishi Univ.	Sustainable Living	IA	*
Montana State Univ.	Sustainable Food & Bioenergy	MT	Agriculture
Mountain State Univ.	Environ Sustainability	WV	Arts & Sciences
Ohio State Univ.	Environ, Econ, Dev & Sustain.	OH	Environ & Natural Resources
Paul Smith College	Natural Res Sustainability	NY	Forestry, Nat Res, & Recreat
Philadelphia Univ.	Environ Sustainability	PA	Science, Health & Liberal Arts
Rensselaer Polytechnic Inst.	Sustainability Studies	NY	Humanities, Arts & Social Sci
Rochester Institute of Tech.	Environ Sustainability	NY	Applied Science & Tech
" " "	Environ Sust. Health & Safety	NY	Environ Studies & Science
St Petersburg College	Sustainability Management	FL	Business
Tennessee Tech. Univ.	Environ & Sust Studies	TN	Environ Studies & Science
Unity College	Sustainable Agriculture	ME	Sustainability & Global Change
" "	Sustainable Energy	ME	" "
Univ. of California - Davis	Sust Agriculture & Food Sust	CA	Agriculture
Univ. of Florida	Sustainability & Built Environ	FL	Design, Constr & Planning
Univ. of Kentucky	Sustainable Agriculture	KY	Agriculture
Univ. of Maine	Sustainable Agriculture	ME	Agriculture
Univ. of Mass - Amherst	Sust Food & Farming	MA	Agriculture
Univ. of New Haven	Sustainability	CT	*
Univ. of Oklahoma	Environ Sustainability	OK	Environ Studies & Science
Univ. of Oregon	Sustainable Commercial Devel	OR	Urban Studies & Planning
Univ. of Vermont	Sustain. Landscape & Hortic	VT	Agriculture
Univ. of South Dakota	Sustainability Studies	SD	Sust Studies & Science

Over 40 B.S degrees exist with the word *Sustainable* or *Sustainability* in the title in the US.

Over 30 B. A. degrees.

There are at least 50 similar degrees in Europe, Canada, S. America, and Australia.

Africa, India, Asia?

Most are *not* at technological universities.



The Emerging Sustainability Career Landscape: Real and Growing

Jobs often focus on best management practices (BMPs) for optimization of discipline-specific systems.

There are dozens of research and management titles and occupations, some include the word *sustainability*, some don't.

Many careers involve *interdisciplinary skills* and are shaped by the unique details of different positions:

- a company that engineers more *efficient energy systems*,
- a university/corporate partnership that *maps supply chains*,
- an gov. agency developing *natural resource management plans*,
- a NGO or law firm working on *science-based public policy*

Lists of jobs and websites are at: www.fit.edu/sustainability/faq



Home

What is Sustainability?

Academics

Campus & Community

Research

Student Organizations

Excellence in Academic Sustainability

Whether the focus is science, engineering, business, or their countless interconnections, Florida Tech has rigorous Bachelor of Science and minor programs in Sustainability with key courses, capstone projects, and many research opportunities. Sustainability opportunities are expanding and graduates build marketability across diverse technical and business disciplines.



ACADEMICS



CAMPUS & COMMUNITY



RESEARCH

Sustainability professionals create and manage environmental, economic, and social systems using interdisciplinary skills across a wide array of careers. Of 750 global CEOs, 91% report their company will employ new sustainability technologies within 5 years ([UNGC, 2010](#)).

As campus members of the Association for the Advancement of Sustainability in Higher Education, Florida Tech students, faculty and staff have access to [many benefits](#) to advance career tracks in sustainability studies through courses, campus projects, and research.

Sustainable systems can be created and maintained with well-designed *best practices* - management routines that improve resiliency and long-term production. As an international leader in education and research, Florida Tech is itself an engine of sustainability. Every day, the university serves to inform, propel and sustain:

- **Best practices in sustainability studies and associated initiatives** through capstone research projects that connect and multiply [Academic](#), [Campus](#), and [Research](#) programs,
- **The discovery and application of new information and tools** through the innovative work of our student body, faculty, staff, and centers of excellence,
- **Leader development in business, government, non-profit, and educational sectors** through top-flight academic programs that graduate workforce-ready sustainability studies professionals.

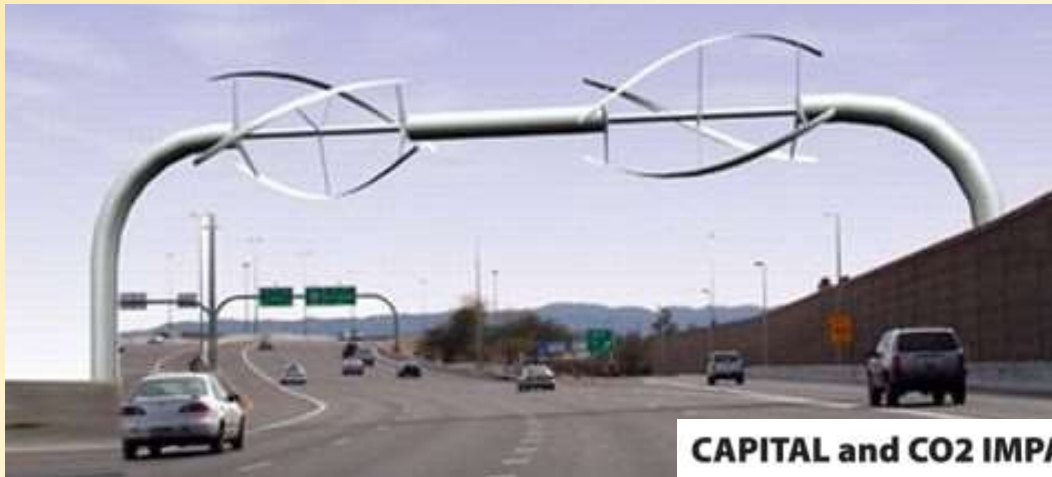


Bachelor of Science – Sustainability Studies

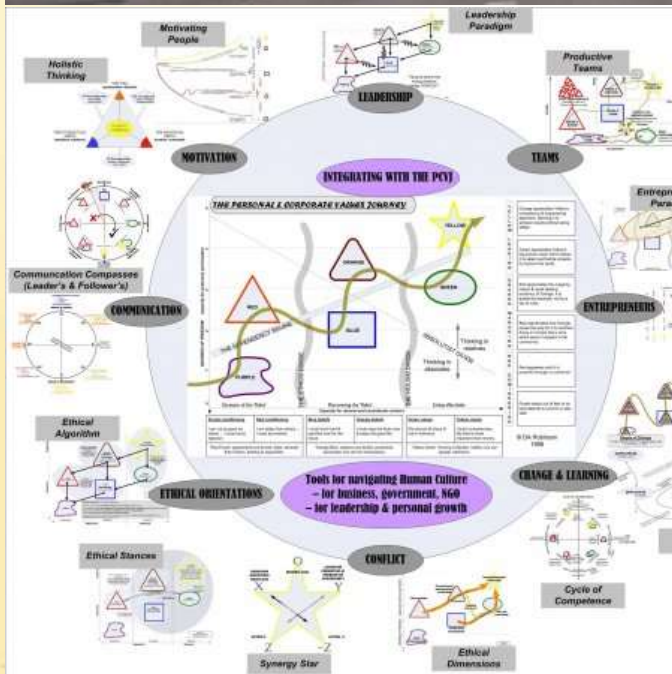
- Scoping concluded that a major was tractable and in demand (e.g., >70 BA/BS degrees in U.S. with more being added).
- Launched in Fall 2013. Currently only 3 other FL universities have bachelor degrees. More coming...
- *Our curriculum is STEM–centric, a brand differentiator; many other programs are BA-type.*
- *Four concentrations are offered at Florida Tech:*
 - *Technol. & Engineering*
 - *Business & Economics*
 - *Environmental Sciences*
 - *Social Sciences.*



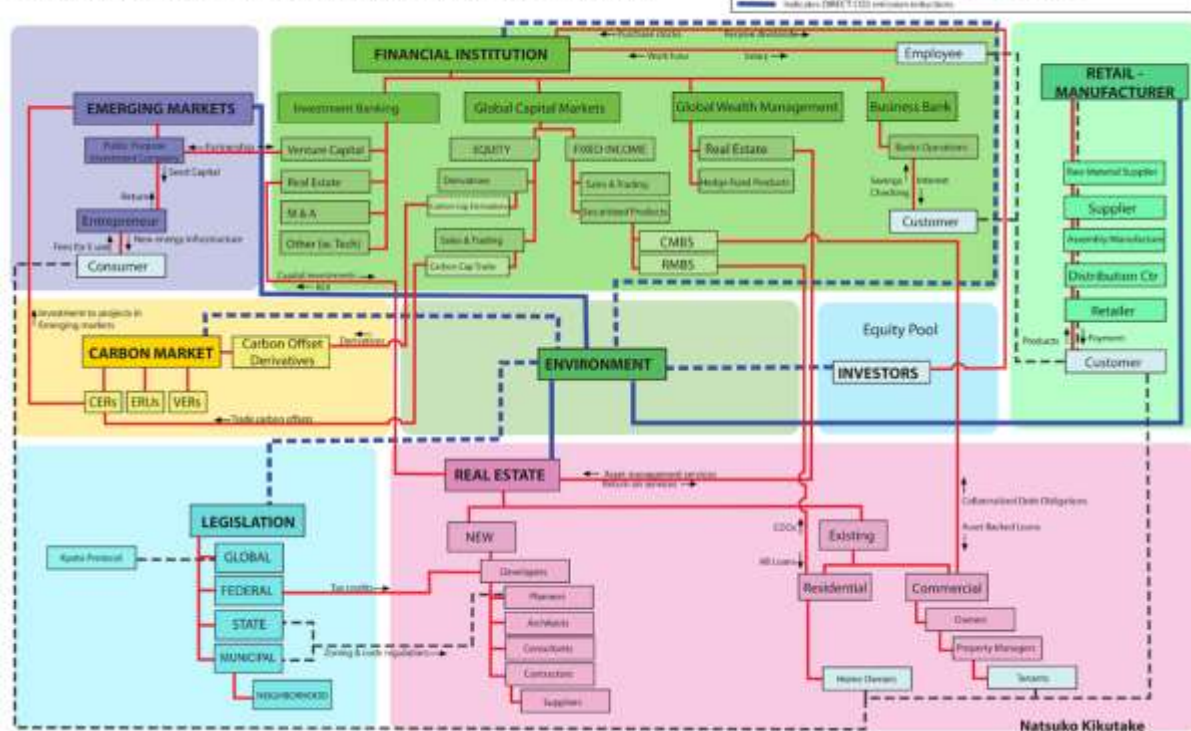
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Sustainability: Hybrid Skills Needed



CAPITAL and CO2 IMPACT FLOW CHART





Degree Requirements – Bachelors of Science in Sustainability Studies

- Candidates must meet minimum course requirements (124 total credits).

These include 1 year each of: *biology, calculus, physics and chemistry.*

- Subsequently, 24 credits of restricted electives from the **four Program**

Concentrations are required as follows:

- **Environmental Sciences** minimum of 6 cr (ES)
- **Technology & Engineering** minimum of 6 cr (TE)
- **Business & Economics** minimum of 6 cr (BE)
- **Social Sciences** minimum of 6 cr (SS)
- To encourage students to focus on areas of greatest individual interest, students take an *additional 15 credits from one or more of the program concentrations* in consultation with their academic advisor.
- These electives are termed “*Concentration Courses*” in the program planning guide. The 15 credits can come from any courses in the list of program electives.

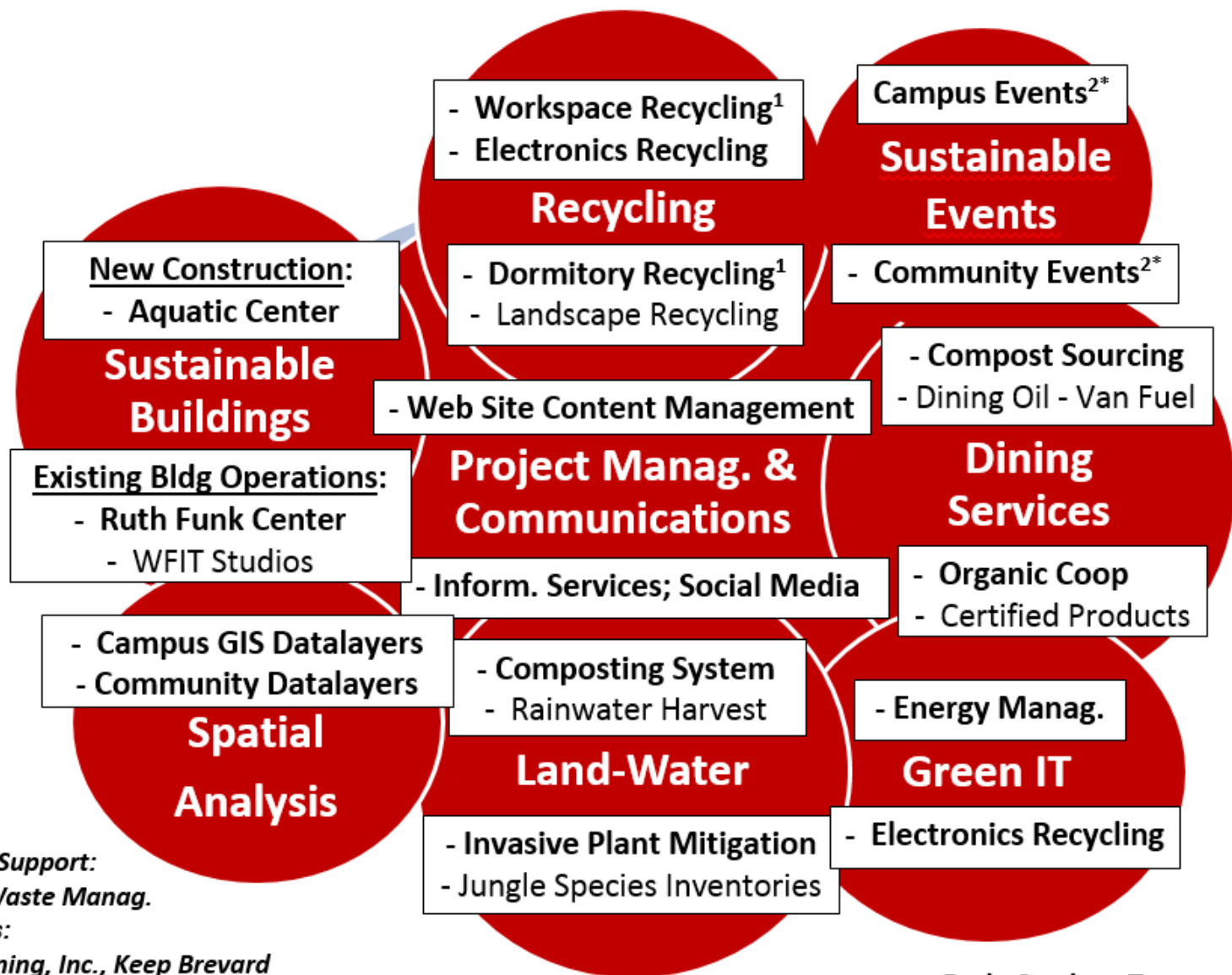


- A collective commitment is growing across campus to make Florida Tech a sustainability leader.
- A ***campus classroom*** model is fundamental – academics & campus efforts are *unified* as possible.
- An ontogenetic (i.e., developmental) process. Many opportunities and strategic are open for strategic exploration as this program grows...
- This requires both a top-down & bottom-up approach.



- Final projects use a *campus classroom model*: students build campus projects to develop marketable skills and operationalize best practices.
- New campus products and services are being created by new *Student-Staff-Faculty Teams* including:
 - Dormitory Recycling - Sustainable Dining
 - Sustainable Events - Land & Water
 - Campus GIS - Sust. Buildings

Florida Tech: Campus & Community Sustainability Initiatives – Nov 2013



¹ Corporate Support:
Siemens & Waste Manag.

² Internships:
Smooth Running, Inc., Keep Brevard
Beautiful, Woman's Business Center, &
International Student Scholar Services

Red: Student Teams
White: Student Projects



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ISC 4000

Applied Sustainability, SP 14

Course projects

All students (24) are in the
Sustainability minor or major

Project		
Green Building Guidelines, Habitat for Humanity	CON	2015
	CON	2014
	CVE	2015
	CON	2015
	CON	2016
	CON	2016
Solar Panel Scoping	SUS	2015
Campus Stormwater Plan (w Facilities)	CVE	2015
	CVE	2014
S Purchasing Plan (w/ Business & Retail Ops)	AERO	2014
	BUS	2015
	CON	2015
Res Hall Move-out	ENS / HUM	2015
Sustainability Marketing	BUS ENV	2015
	CON	2015
Sustainable Transportation Plan (w Facilities)	ISC	2015
	MAE	2014
Sustainable Events and Community Projects	MAR BIO	
	BUS	2015
	HUM	2016
	MAR BIO	2014
	MAR BIO	2016
	ENS	2014
	CBE	2015



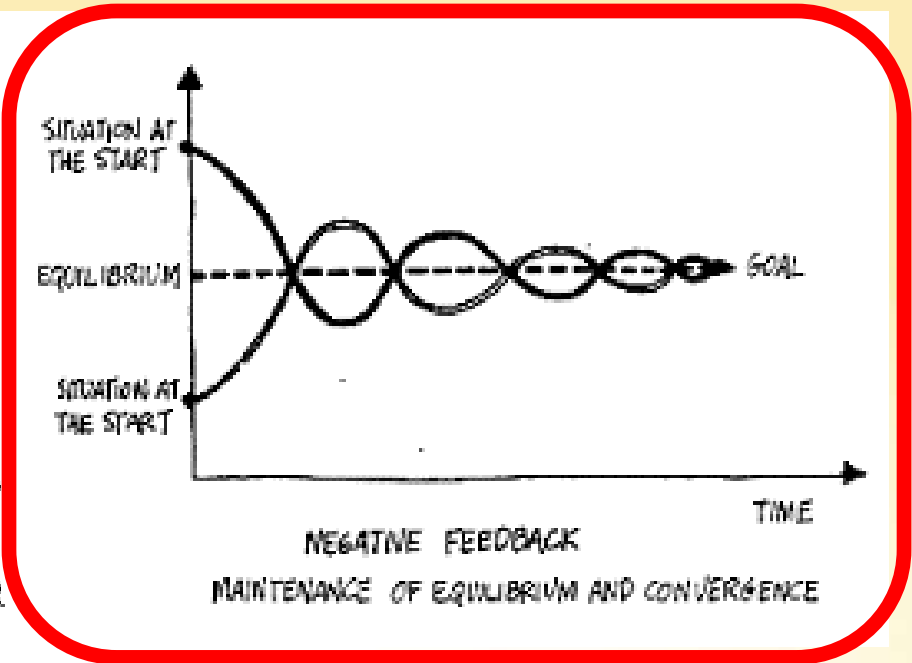
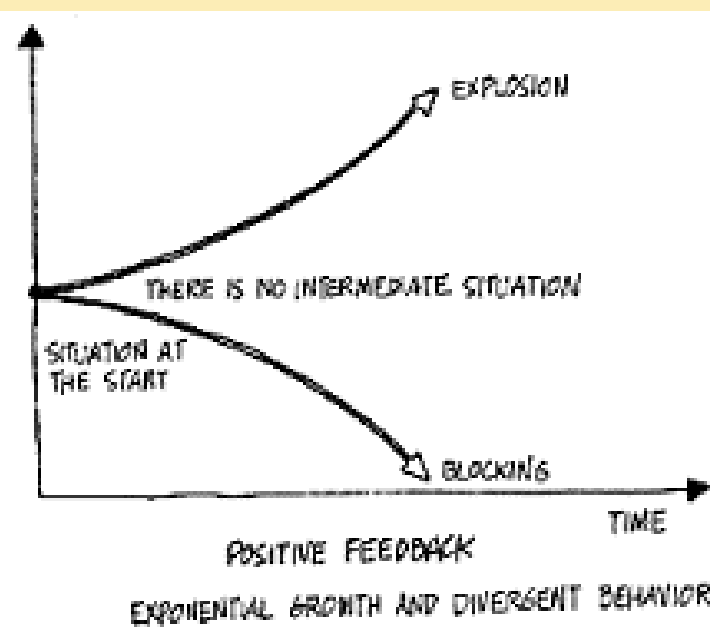
Merging many diverse disciplines produces new concepts and vocabularies

- Energy poverty
- Solar shingles
- Climate refugees
- Failed states
- Microcredit
- Social traps
- Triple bottom line
- Rainwater harvesting
- NGO
- Grasstops
- BMPs
- Vampire power



Thinking in Systems, Meadows (2008)

- Feedback Loops
 - Amplifying
 - Stabilizing
- Limits control systems (bottlenecks)
- Limits are numerous and layered
- Response Delays are common and extended
- Bounded Rationality...
- SYSTEM TRAPS



- Negative feedback causes system outputs to lessen - and to trend the system to equilibrium.
- - *equilibrium* in mechanics
- - *homeostasis* in biology
- - *rules/regulations* in law and government.



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Sustainable Systems

require

Dynamic Equilibrium

which is undone by

Uncontrolled Feedback Loops

which create

System Traps



System Traps (Meadows, 2008)

Success to the Successful (= Winner Take All; The Monopoly Effect)

Seeking the Wrong Goal

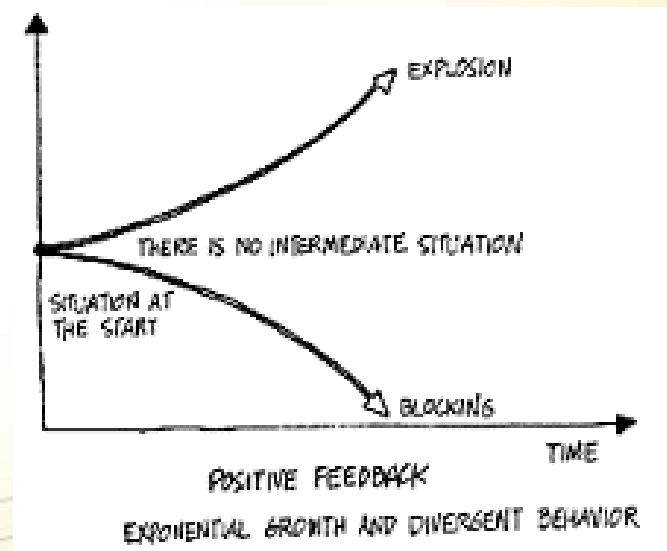
Shifting the Burden (= Addiction...)

Rule Beating

Drift to Low Performance

The Tragedy of the Commons

Escalation





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FIT Virtual Climate Adaptation Library

≥1400 pdfs on adaptation tools for coastal areas by state country.

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Virtual Climate Adaptation Library

Archives: US: Florida US: East Coast US: Gulf Coast US: West Coast & Hawai'i US: National Canada Latin America & Caribbean Europe Africa Middle East Asia & Indian Ocean
Australia & New Zealand Pacific Islands Global Climate Communications

Coastal Climate Change: Adaptation Planning & Implementation
Cloud-based archives on local through international coastal climate planning since 2009.

- Over 1250 reports/articles are in 15 directories and >80 subdirectories above.
- Planning guidelines in >10 languages available (English, Spanish, Chinese, Arabic, Japanese, German, Hindi, Portuguese, French, Italian, Russian)
- Articles and reports are welcome in any language (below).

Other Adaptation Planning Resources - Southeast U.S. and National U.S.
Wide arrays of related resources are also available at the [Climate Adaptation Knowledge Exchange](#), [Ecosystem-based Management Tools Network](#), Georgetown University's [Adaptation Clearinghouse](#), NOAA's [Digital Coasts](#), [Storm Smart Coasts](#), and other resources. Sources of webinars include:

- **EBM:** Webinars are offered on spatial management, including climate planning, at the portal of the [Ecosystem-based Management Tools Network](#).
- **ICLEI:** Webinars are hosted on local planning for sustainability by Local Governments for Sustainability - ICLEI, ICLEI Southeast U.S. webinar archives.
- **CCS:** Webinars on climate, energy, and economics are hosted by the Center for Climate Strategies.
- **SACE:** Webinars are hosted by [CleanEnergy.org](#). Webinar archives are available from 2008.

Submissions
We thank many colleagues who have contributed files from diverse regions. If you have documents on coastal climate adaptation to forward, please contact slibrary@fit.edu. Use of copyrighted material is restricted to nonprofit educational purposes only and is not intended for commercial use. If the owner of any work should wish a document to be removed, please contact slibrary@fit.edu.

Of Note:
Surging Seas. Strauss et al. 2012.
Adaptation Tool Kit: Sea-level Rise & Coastal Land Use. GCC. 2011.
Protecting Florida's Communities. DCA, 2005. Little known and exceptional.

RSS Feeds
Scientific American: Global Warming & Climate Change

- What Can Scientists Say about Ethics and Economics of Combating Climate Change?
- Climbing Mount Everest: My Search for Dirty Snow
- Do U.S. Climate Change Reports Need to Change?

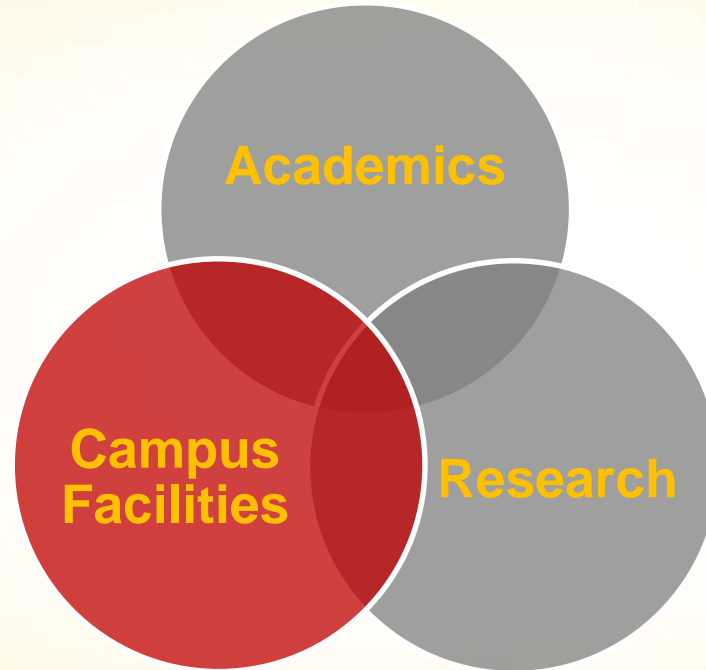
Partners: Sea Grant, StrongerSafer FLORIDA, MOTE Marine Laboratory, NOAA, Sea Turtle, Penn, MRC, CleanEnergy.org, and others.

Search: “Sea Level Rise Library”



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University Sustainability:



[Home](#)[What is Sustainability?](#)[Academics](#)[Campus & Community](#)[Research](#)[Student Organizations](#)

Solar Fleet of Campus Vehicles – Recharging

CAMPUS & COMMUNITY

Campus & Community

[Home](#)[Recycling](#)[Sustainable Buildings](#)[Dining Services](#)[Land/Water Management](#)[Sustainable Events](#)[Communication](#)[Campus & Community Trolley](#)

Students as Innovators

Diverse student, staff, faculty, and community partners have started new sustainability initiatives. Some programs combine academic courses and student capstone projects to produce innovations on and off campus.

Sustainability capstone projects use a *campus classroom* model: students develop and manage real-world sustainability projects to generate solid learning experiences and sharpen marketable skills. These efforts include student-staff-faculty teams working on issues such as:

- [Recycling](#): Projects include electronics, dormitory, and workspace recycling. Best practices are re-inforced by e-mail, social, and print media products with the communications team and [Facilities Operations - Recycling](#). Corporate donors include [Siemens Engineering](#) and [Waste Management](#).
- [Sustainable Buildings](#): Students assist implementation of best practices in building management systems. Students have worked on diverse LEED and FGBC credits on energy, indoor air, water management, and other systems with buildings staff in [Facilities Operations](#).
- [Dining Services](#): Sourcing of food waste for the composting project, expansion of certified sustainable coffee options, and cooking oil to power university vehicles are among the projects scoped or implemented for [on-campus dining options](#).
- [Land & Water](#): Students and staff maintains a vermiform composting system using waste from two campus dining halls (SIR and Panther Dining Hall). Both soil and liquid tea super-fertilizer is harvested from wormhouses in our 16

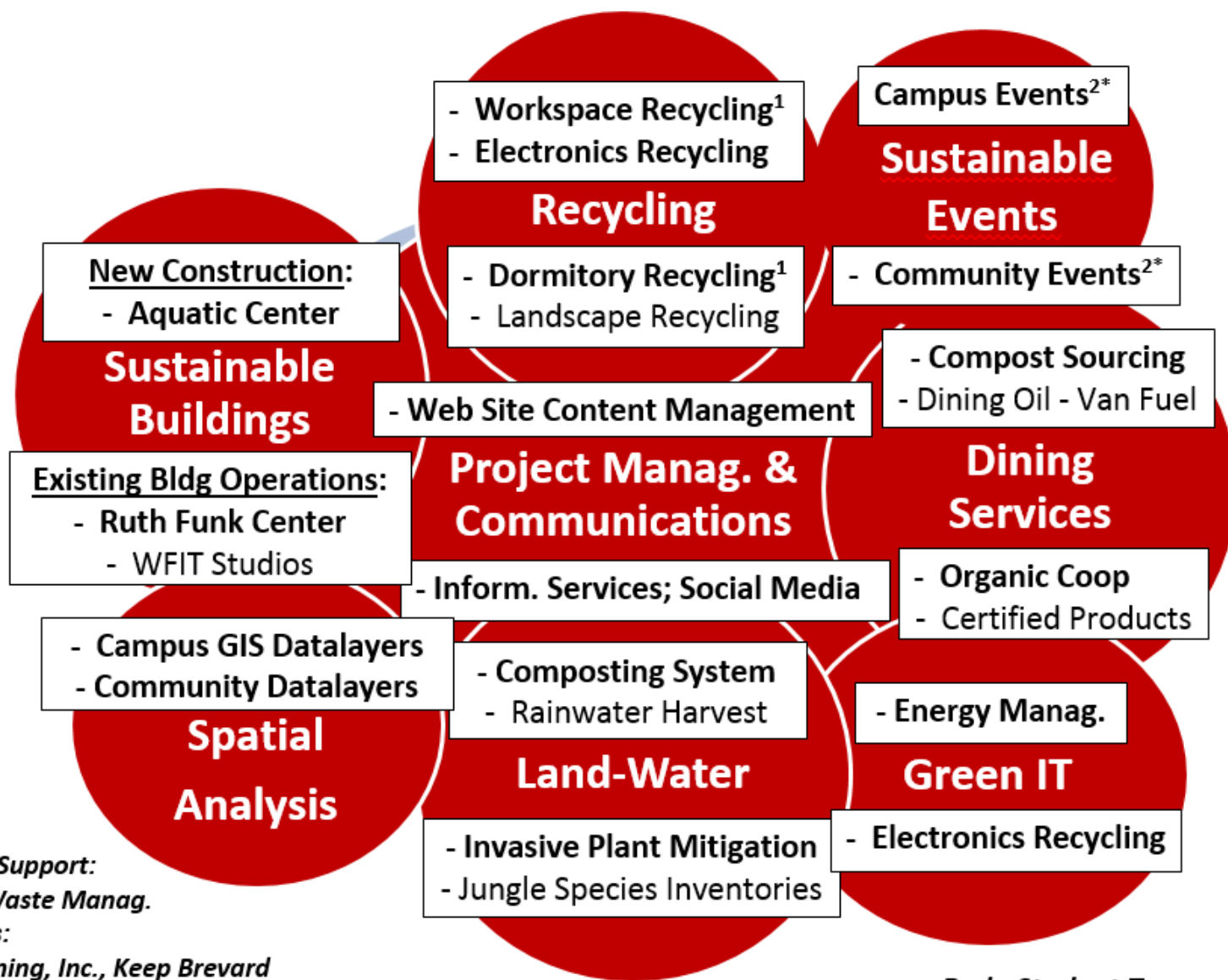
Bicycle Sharing at FIT

Our Student Government Association provides bikes to students on a space-available basis. Go by the SGA office in the Evan's Student Center to check one out!





Campus Classroom Products include:



¹ Corporate Support:
Siemens & Waste Manag.

² Internships:
Smooth Running, Inc., Keep Brevard
Beautiful, Woman's Business Center, &
International Student Scholar Services



Campus & Facilities Sustainability

Siemens Energy Savings Performance Contract

- New 1,000-ton Central Water Plant powered by two state-of-the-art high efficiency turbo-core chillers
- Installation of office lighting motion sensors and window solar film across campus
- **Annual reduction of 6,500 tons in greenhouse emissions**
- **Major annual electricity savings campus-wide (approximately 27%; 8,000,000 KWh)**



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Solar-Powered Maintenance Fleet

Facilities Management reduced carbon emissions and fuel costs by replacing some of its gas-powered fleet with electric carts and building a solar-charging station.

These university carts recharge by drawing from the grid at night, when rates are lower.





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The Botanical Gardens: Our Unique Jungle

- 16-acre subtropical preserve and flood plain that contains more than 200 species of palms, bamboos, and ferns.



- Cited in the AAA Travel Guide and used by F.I.T. students for outdoor recreation and studying for over 50 years.





Sustainable Buildings: Student - Facilities Team Products

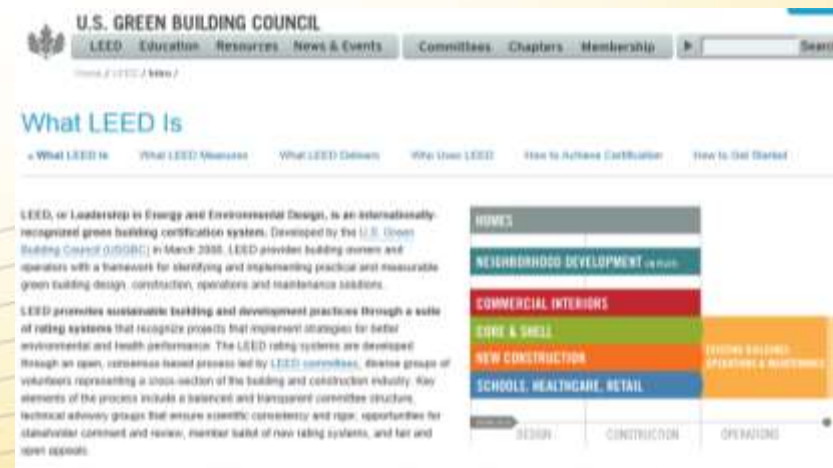
- LEED = the global building standard that incentivizes underused best practices.
- Ultimately saves energy & water \$\$
- Four rating levels based on credits earned among dozens of sustainability criteria:





Student Sustainability Projects for LEED

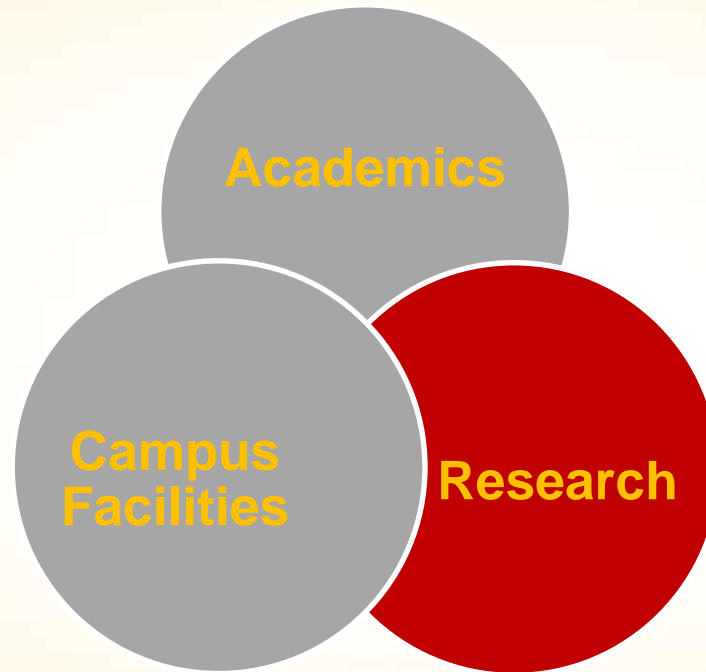
- Academic partnerships with Facilities as part of Sustainability class projects:
- Students *assess and document specific credits needed* to achieve certification.
- Outside firms often bill \$1.5K per credit, but we minimize these expenses by using student projects.





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University Sustainability:





Research Activities

Sustainability is a theme in funded faculty research across many departments and all colleges. Direct and indirect sustainability research occurs among dozens of faculty members and includes:

- ecosystem monitoring and conservation,
- cyber security,
- coastal management,
- groundwater quality and storm water management,
- corporate social responsibility,
- aquaculture of food and ornamental fish species
- paleoecology and climate change,
- green chemistry
- recycled materials in road construction,



Next steps common to the development of university sustainability programs:

- Campus sustainability certification via STARS
- Campus climate plan and GHG inventory

These two fundamental steps (and others) won't properly happen without a:

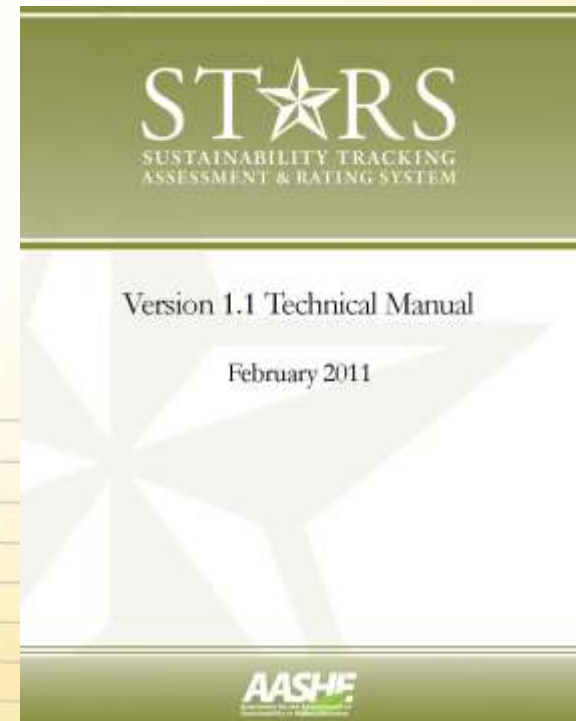
- Campus Sustainability Director



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What is STARS?

- *Sustainability Tracking, Assessment & Rating System*
- The premier university campus sustainability eco-label
- A voluntary, self-reporting framework
- A common standard of measurement for sustainability in higher education
- Managed by *AASHE*...





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AASHE: Association for the Advancement for Sustainability in Higher Education

- An association of colleges & universities working to *“Empower higher education to lead the sustainability transformation”*
- Over 1000 college/university members.
- Professional home for campus sustainability officers.
- Accreditation home for STARS





STARS®

SUSTAINABILITY TRACKING
ASSESSMENT & RATING SYSTEM

The Sustainability Tracking, Assessment & Rating System™ (STARS) is a transparent, self-reporting tool for colleges and universities to measure their sustainability progress. STARS® was developed by AASHE with broad participation from the higher education community. The system includes environmental, economic, and social indicators, which are divided into four categories related to campus activities: Education & Research, Operations, Planning, Administration & Engagement, and Innovation. All of the requirements for evaluating and scoring institutions are transparent and made publicly available. Points are earned in each category and lead to a STARS Rating (listed below). Any institution that wishes to participate in STARS but does not want to publish its scores may participate as a STARS Reporter.



STARS:

- Provides a framework for understanding sustainability in all sectors of higher education.
- Enables meaningful comparisons over time and across institutions using a common set of measurements developed with broad participation from the campus sustainability community.
- Creates incentives for continual improvement toward sustainability.
- Facilitates information sharing about higher education sustainability practices and performance.
- Builds a stronger, more diverse campus sustainability community.

If you can't measure it, you can't claim it...



Other Next Steps at F.I.T.

- *all depend on additional funding*
- Additional LEED or FGBC buildings
- Expanded solar energy generation - when possible as cost/benefit analyses suggest
- Endowed funding support
- Many other items (see STARS list of credits)



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Questions?

The Academic Program?
Sustainability Research?
Jobs and Sustainability?



SIEMENS