SCIENCE, ENGINEERING, AND EDUCATION FOR SUSTAINABILITY (SEES)

$52,480,000
-$22,250,000/ -29.8%

Overview

A sustainable world is one in which human needs are met equitably without harm to the environment and without sacrificing the ability of future generations to meet their needs. Meeting this formidable challenge requires an increase in understanding of the integrated system of society, the natural world, and the alterations humans bring to Earth. NSF's Science, Engineering, and Education for Sustainability (SEES) activities aim to address this need through support for interdisciplinary research and education activities that cross the boundaries of the physical sciences, natural sciences, engineering, mathematics, computational sciences, human behavior, the social and economic sciences, and educational sciences to develop new understandings, theories, models, and technologies.

Total Funding for SEES

(Dollars in Millions)

FY 2015 Actual	FY 2016 Estimate	FY 2017 Request
$183.01	$74.73	$52.48

Goals

SEES activities span the entire range of scientific domains at NSF and have three overarching multi-year goals:
1) Support interdisciplinary research and education that can facilitate the move towards global sustainability;
2) Build linkages among existing projects and partners and add new participants in the sustainability research enterprise; and
3) Develop a workforce trained in the interdisciplinary scholarship needed to understand and address the complex issues of sustainability.

Approach

SEES is a multi-year effort to coordinate and grow research and education associated with the environment, energy, and sustainability. NSF's work under SEES is a blend of activities − formal solicitations and less formal announcements of interest (e.g., Dear Colleague Letters) − that span multiple scientific disciplines and require input and oversight from multiple NSF directorates. Research on complex environmental pathways is supported and emphasized across NSF and is supplemented by activities focused on sustainable materials and technologies. SEES activities also help to build up the cross-disciplinary workforce for sustainability research and education, and to engage students and the public on sustainability science and engineering and their social implications. NSF conducts this work in awareness of and in concert with other federal agencies and national and international stakeholder groups whose function and mission complement NSF's role to ensure that sustainability goals are carried forward.

SEES programs are rooted in long-term, ongoing, environmental, energy, and education research. The portfolio approach—as opposed to a large single program—facilitates coordination, monitoring, and impact across the major investment areas and also across NSF, as SEES activities are complex and highly interdisciplinary. The SEES organizational structure includes:
- A senior leadership committee composed of assistant directors/office heads to provide overall planning and guidance;
- Cross-agency working groups of program directors, each overseen by assistant directors/office heads/division directors who are most relevant to the specific activity to manage programs or activities; and

- Interagency working groups and international partnerships to carry out transition planning as the initiative sunsets in FY 2017.

Investment Framework

SEES Funding by Directorate

(Dollars in Millions)

	FY 2015 Actual	FY 2016 Estimate	FY 2017 Request
BIO	$21.00	$17.50	$17.50
CISE	13.32	-	-
ENG	19.39	3.00	3.00
GEO	59.00	34.00	18.50
MPS	50.85	16.00	13.00
SBE	3.00	-	-
OISE	16.45	4.23	0.48
Total	**$183.01**	**$74.73**	**$52.48**

Totals may not add due to rounding.

FY 2010 – FY 2015

NSF established the SEES investment area in FY 2010 in order to use a systems-based approach to understanding, predicting, and reacting to change in the linked natural, social, and built environment and to address challenges in environmental and energy research and education. NSF supported sustainability-related research and education for decades and SEES built on this foundation by bringing programs that address sustainability into a common framework to optimize investments and outcomes. The initial programs in FY 2010 were the Climate Change Education Program, Dimensions of Biodiversity (DoB), Earth Systems Modeling (EaSM), Ocean Acidification (OA), and Water Sustainability and Climate (WSC).

In FY 2011, NSF maintained momentum in the SEES investment area by augmenting existing programs and issuing a Dear Colleague Letter. In FY 2012, NSF expanded SEES through significant investments in four new programs: SEES Fellows; Sustainability Research Networks; Sustainable Energy Pathways; and a SEES-focused Partnerships for International Research and Education (PIRE) competition. In FY 2013, NSF initiated five SEES programs – Coastal SEES, Arctic (ArcSEES), Hazards SEES, Cyber SEES, and Sustainable Chemistry, Engineering and Materials (SusChEM) -- to complement earlier programs and to focus on environmental, technological, and societal resilience; dissemination of results; responsiveness to societal needs; and workforce development.

NSF continued to support and coordinate the many SEES programs throughout FY 2014 and FY 2015. In the case of some multi-year continuing awards, FY 2015 funds were used to support activities in the following fiscal year. SEES competitions in FY 2014-2015 included: DoB, WSC, CyberSEES, Coastal SEES, Dynamics of Coupled Natural and Human Systems (CNH), Hazards and Disasters (Hazards SEES), SusChEM, Arctic SEES, and Food Systems. Of particular note is the Sustainability Research Networks (SRN) solicitation focused on increasing understanding of the complicated landscape of urban sustainability, which has emerged as a critical need for the 21st century.

FY 2016
The FY 2016 estimate for SEES is $74.73 million. FY 2016 funding will support the following SEES programs: DoB, EaSM, SRN, Coastal SEES, Hazards SEES, SusChEM, and PIRE. SEES programs continue to support important scientific and societal contributions during this phase-down period, and to make significant progress towards achieving programmatic goals through existing projects. During FY 2016, NSF continues to stress consolidation and coordination of existing activities in keeping with the sunsetting of the investment area in FY 2017.

FY 2017 Request
While FY 2017 is the last year in which funding will be formally associated with the SEES portfolio, NSF has and will continue to invest in and make progress towards the research necessary for a sustainable human future, via SEES and many other programs and mechanisms. FY 2017 SEES funding will support the DoB, EaSM, SRN, Coastal SEES, and SusChEM programs. NSF senior management is planning for the Hazards and WSC programs to continue beyond 2017. NSF plans to continue support for Hazards-related research projects under NSF's Risk and Resilience investment area. Aspects of the WSC program and food and energy systems sustainability research will be folded into the Innovations at the Nexus of Food, Energy, and Water (INFEWS) investment area. SusChEM is anticipated to transition to an ongoing program among three NSF directorates (MPS, ENG, and GEO). SEES programs with ongoing community interest that will be supported through NSF core programs include: ArcSEES, Coastal SEES, DoB, EaSM, OA, and CNH (SEES track).

Evaluation Framework
Significant thought has gone into how to define success under SEES, and monitoring and evaluation have been aspects of the SEES portfolio since its inception. The progress of the implementation of this investment was monitored and reviewed quarterly as part of a performance goal in FY 2014 and FY 2015. For more information about monitoring key program investments, see the FY 2015 Annual Performance Report in the Performance chapter. Additionally, NSF has received abundant internal and external feedback on the portfolio and its programs through trans-disciplinary workshops, advisory committee meetings, a National Academies conference, and various newsletters, articles, and publications. In FY 2014, NSF issued a Request for Quotes and awarded a contract for evaluation of the SEES portfolio. Evaluation activities under the contract include:

- **Evaluation Design and Plan** − developing research questions and framework for analysis, including logic models, and developing data collection instruments and methodologies for those analyses (final plan delivered December 2014; final evaluation report due December 2017).
- **Historical Review** − understanding of sustainability-related activities over time, how SEES fits into history, and to discern if the coordinated approach under SEES has brought about different outcomes in terms of increased productivity, scientific findings, and interest level (final report delivered July 2015).
- **Comparative Analyses of SEES and non-SEES NSF programs** − to determine if activities conducted and programs developed under the SEES portfolio are achieving different outcomes compared to similar NSF programs, and if the SEES portfolio is filling a gap in the sustainability science, engineering, and education enterprise. Contract deliverables for this task include:
  - Comparison of SEES solicitations (final report delivered July 2015)
  - Comparative Analysis of SEES and non-SEES programs (in progress, due October 2016)
  - Indicators Report on value of SEES as a portfolio of programs (in progress, due November 2016)
  - Comparison of workforce development and training in SEES and non-SEES programs (due November 2017).
- **Network Analyses** – development of collaboration indicators, influence of participation in SEES programs on individual researchers, and a comparison of networking activities of SEES and non-SEES individuals. Contract deliverables for this task include:

- Collaboration Indicators report (due June 2016)
- Final Report on Influence of Participation in SEES (due March 2017)
- Final Report on Comparison of Networking Activities between SEES and non-SEES Participants (due April 2017).