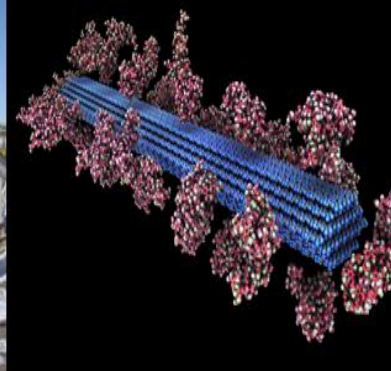




U.S. DEPARTMENT OF  
**ENERGY**

Energy Efficiency &  
Renewable Energy



# Analysis and Sustainability 2013 Project Peer Review

Alison Goss Eng  
BETO Operations Lead

# Introduction: Analysis & Sustainability

Expanding to commercial-scale volumes while delivering on the promise of clean renewable energy requires proactively:

- Understanding resource availability
- Considering complex policy, socioeconomic, market, and environmental factors
- Developing beneficial collaborative solutions with diverse stakeholders
- Promoting technologies and best practices that enable a viable, large-scale advanced biofuels industry



# Goals and Objectives

## Strategic Analysis

Provide context and justification for decisions at all levels by establishing the basis of quantitative metrics, tracking progress toward goals, and informing portfolio planning and management

## Cross-Cutting Sustainability

Understand and promote the positive economic, social, and environmental effects and reduce the potential negative impacts of bioenergy production activities

# Role in Advancing BETO's Mission

- Analysis & Sustainability plays a cross-cutting function
  - Guides program planning functions, target defining and validating, and tracking progress toward goals
  - Works with BETO Technology Areas to develop and advance technology-specific sustainability and analysis objectives
  - Collaborates with other DOE offices and external agencies
  - Monitors and provides technical input on policy and international dialogues on bioenergy



# Background Information

- History
  - Strategic Analysis has always an integral part of the program
  - Sustainability has historically been central to the Feedstocks platform
  - A&S first represented as a budget line item in 2011 in response to
    - Growing needs resulting from RFS2
    - Increased concerns about corn ethanol, land use, and “food vs. fuel”
    - Reviewer feedback from 2009 Peer Review
- Relationship to BETO goals
  - Conducts key analyses to guide planning and portfolio management and provides the analytical basis for R&D prioritization, target development and assessment of progress towards goals
  - Proactively addresses sustainability through RD&D investments to increase scale-up potential, public acceptance, and long-term viability of the Office’s technology investments

# Key Accomplishments

- Following successful demonstration of cellulosic ethanol targets, coordinated selection of technology pathways to hydrocarbon biofuels that will guide bioenergy R&D investment in the near to mid term
- Established indicators and frameworks for evaluating sustainability
  - Environmental: GHG emissions, soil quality, water quality and quantity, air quality, biodiversity, productivity, and land use
  - Socioeconomic: social acceptability, social well-being, energy security, external trade, profitability, and rural development
- Contributed foundational and first-of-kind publications and analyses
  - Sustainability metrics for multiple feedstocks and conversion pathways
  - GHG lifecycle analysis on diverse pathways and fuels
- Completed bi-annual updates to BETO Multi-Year Program Plan in support of strategic planning

# Key Barriers

## Analysis & Sustainability Barriers

Insufficient data across the supply chain

Lack of comparable, transparent, and reproducible analysis

Limitations of analytical tools for systems-level analysis

Limited quantification of economic, environmental, and social benefits and impacts of bioenergy

Nascent nature of sustainability indicators and best practices

Lack of consensus, data, and proactive strategies for addressing land use impacts

# Approach

- Role in overcoming key barriers
  - Developing and disseminating new technologies, tools, and mechanisms for more informed decisions and better resource management
  - Building capacity and collaboration through stakeholder engagement (e.g., workshops, roundtables)
  - Strategic Analysis: model development, data collection, and analysis
  - Sustainability: applied research, field work, modeling, and analysis
- Partners with National Labs and diverse stakeholders
  - Primarily ANL, INL, NREL, ORNL, PNNL
  - Collaboration with NGOs, academia, industry, international organizations
- Coordinates cross-cutting objectives internally and externally
  - BETO technology areas: Feedstocks, Conversion, D&D
  - DOE Offices: Vehicles, Fuel Cells, Strategic Programs
  - Agencies: USDA, EPA, DOD, DOT (FAA)

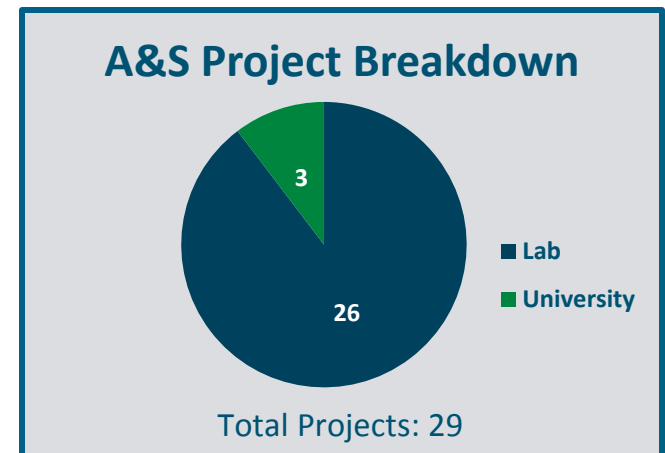
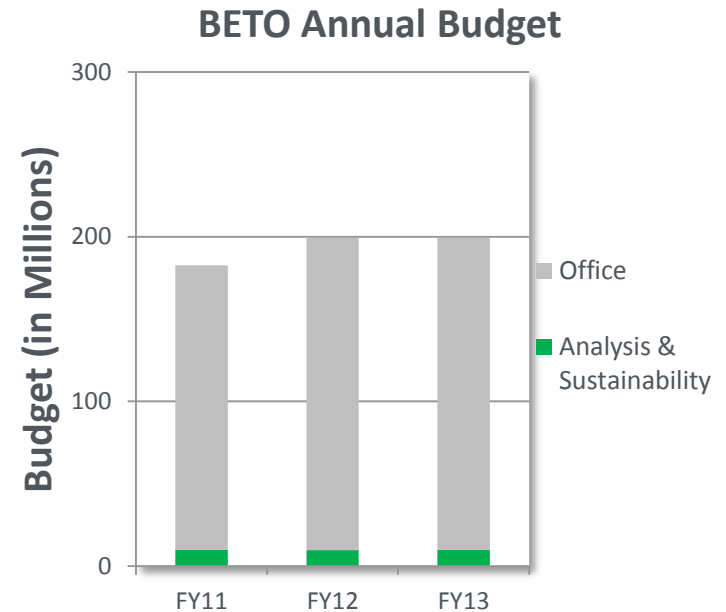


# Systems Integration

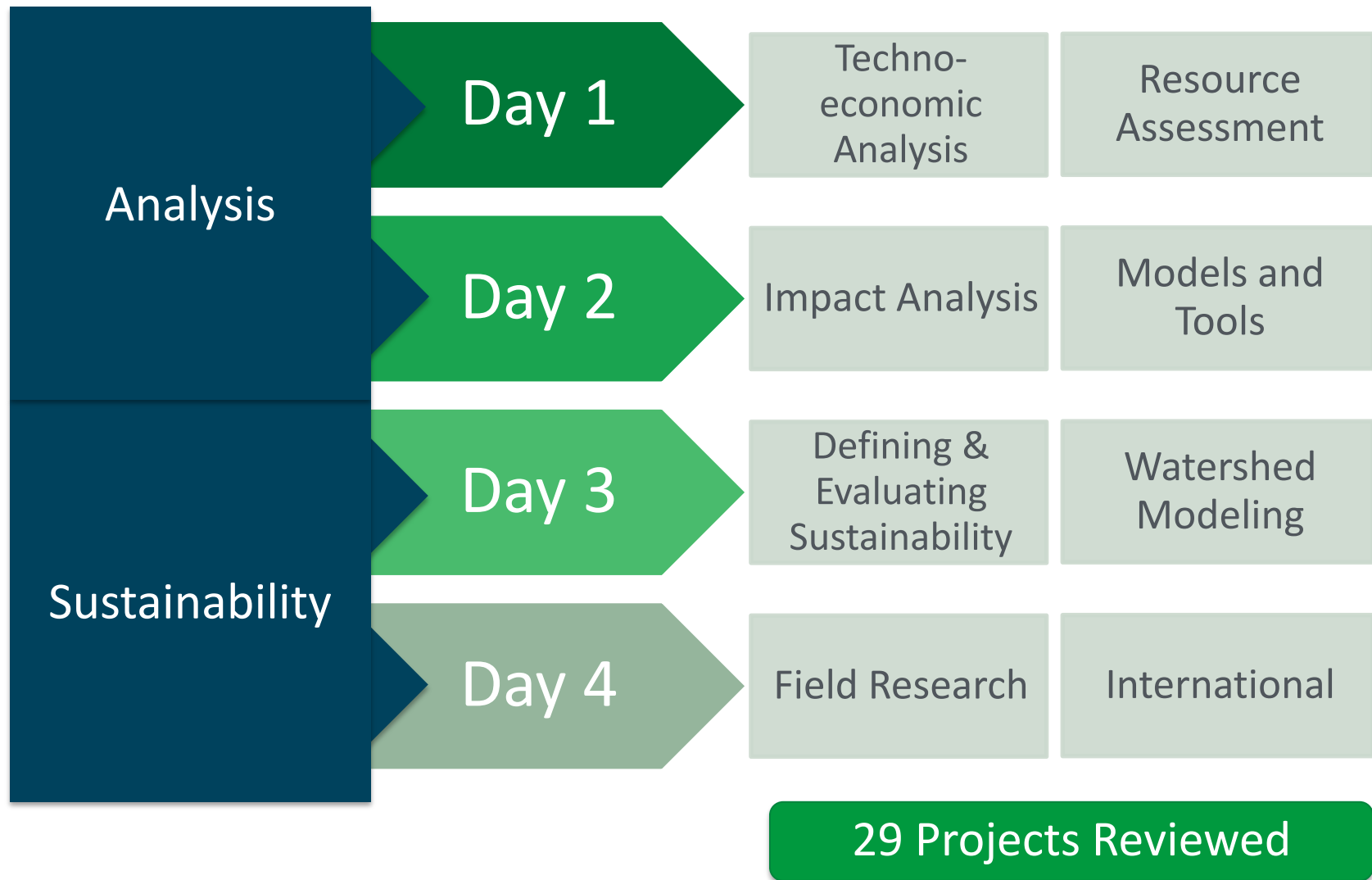


# Budget Information

- A&S annual budget \$10M FY11-FY13
  - Analysis
  - Sustainability
  - Systems Integration
- Most projects are at National Labs
  - maintaining core capabilities and expertise
  - consistent analyses over time to evaluate progress
  - developing models and tools accessible to all stakeholders
  - as-needed and quick turn-around analyses

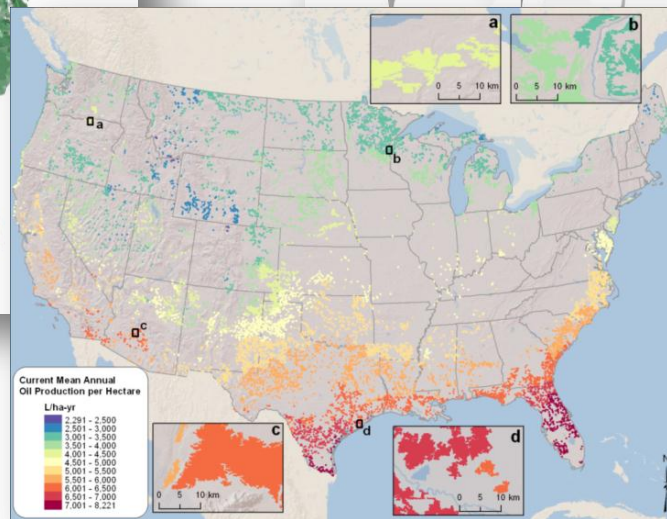
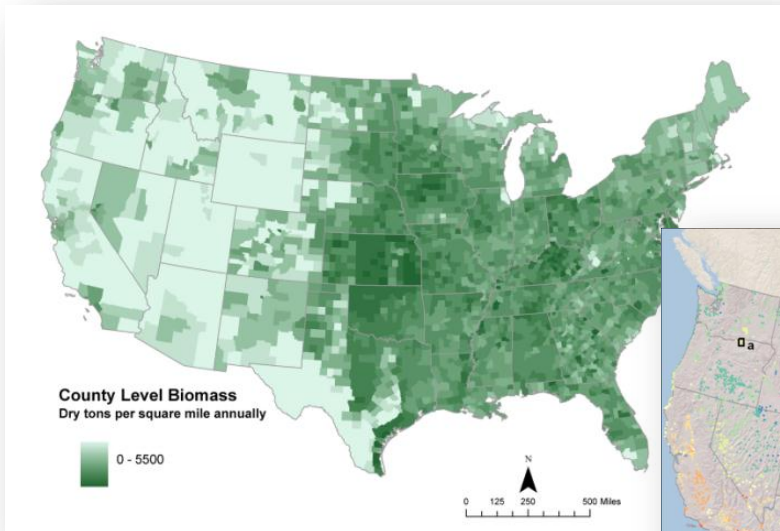


# Project Portfolio



# Project Portfolio

- Techno-Economic Analyses
- Resource Assessments
  - Terrestrial and algae feedstocks



PNNL

U.S. DEPARTMENT OF ENERGY

Energy Efficiency & Renewable Energy

# Project Portfolio

- Impact Analysis
  - Land Use Change, Benefits Assessment, Scenario Analysis
- Models and Tools
  - Bioenergy Knowledge Discovery Framework, GREET, Biomass Scenario Model and other models
- Defining and Evaluating Sustainability
  - Sustainability indicators and metrics
  - Life-cycle assessments of multiple feedstocks and pathways

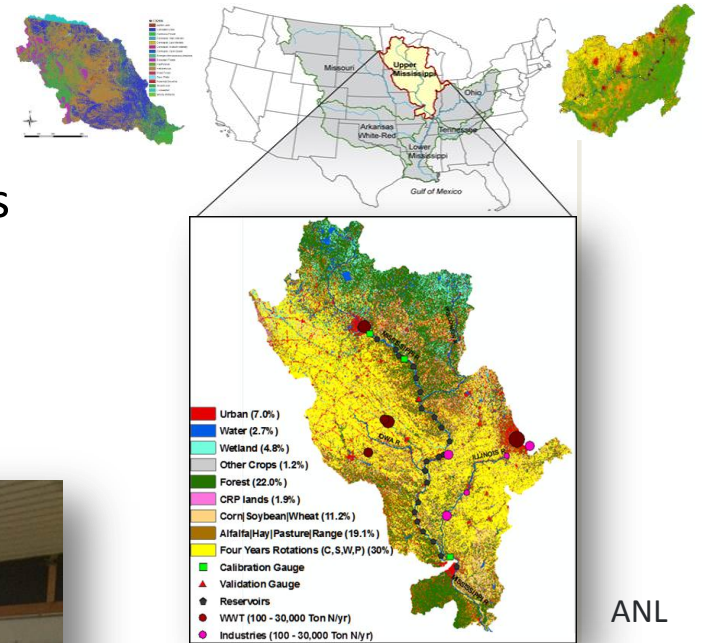
The screenshot shows the Bioenergy Knowledge Discovery Framework (KDF) website. The header includes the KDF logo, the text "BIOENERGY KNOWLEDGE DISCOVERY FRAMEWORK", and "U.S. DEPARTMENT OF ENERGY". Navigation links include "OVERVIEW", "TOOLS & APPS", "MAP", and "BIOENERGY LIBRARY". A search bar is present in the top right. Below the header, there is a green banner with text: "The Bioenergy KDF provides access to collaboration, data management, analysis, and visualization tools designed to support bioenergy research. In the KDF, users can share data, access value-add tools to use the data in new ways, and combine data sets from various sources to maximize their impact." Below this is a section titled "What Would You Like To Do?" with four interactive buttons: "ADD DATA", "FIND DATA", "VISUALIZE DATA", and "FIND TOOLS & APPS". Further down, there is a "Featured Content" section with a thumbnail for "Optimal Biorefinery Locations and Transportation Network for the Future Biofuels Industry in Illinois". To the right is a "Popular Data Sets" section listing several datasets. Below these are "News" and "Events" sections with recent updates.

**GREET**  
LIFE-CYCLE MODEL

**Potential savings to Program from Billion Ton Study interface on KDF: ~\$1,000,000 (up from \$340,000 in 2012!)**

# Project Portfolio

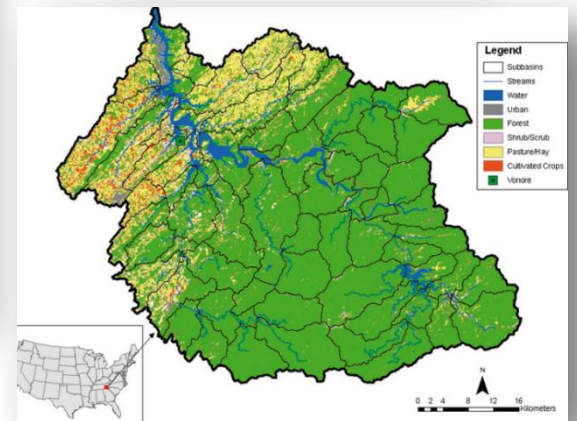
- Watershed Modeling
  - Multiple scales, feedstocks, and regions
- Field Research
  - Best practices for bioenergy feedstock production



ANL



Bioenergy Crop Workshop, March 2013 in Fairbury, Illinois (ANL)



ORNL

# Project Portfolio

- International
  - Global Bioenergy Partnership
  - International Energy Agency
  - Roundtable on Sustainable Biomaterials
  - International Standards Organization
  - Other multi-national partnerships



# Future Directions

- Ongoing work in this Technology Area is cross-cutting, foundational, and critical to the Office meeting its goals
  - Continue techno-economic analysis, resource assessments, and impact analysis: Interface with other technology areas
  - Support development and maintenance of models and tools: Bioenergy KDF, GREET, BSM, others
  - Identify and disseminate sustainability best practices: Stakeholder outreach, inter-agency interactions, and promoted through BETO-funded projects
  - Evaluate and document sustainability metrics and indicators: Including productivity, GHG emissions, water quality and quantity, soil quality, air quality, biodiversity, and socio-economic impacts



# Future Directions

- New areas of focus in FY14
  - Market Analysis: Advanced biofuels and bioproducts
  - Deployment support: Explore opportunity and challenges associated with super premium, high octane fuels
  - Natural Gas – Biomass to Liquids: Explore potential DOE role
  - Policy: Analyze and inform the development of public policies
  - Innovative Landscape Design: Demonstrate landscape concepts that increase productivity and improve ecological attributes

# Integration of Feedback from 2011 Peer Review

- In response to the 2011 Peer Review, A&S :
  - Initiated a monthly teleconference to facilitate communication and collaboration among project performers
  - Rolled the Bioenergy Databook into the Bioenergy KDF
  - Organized an external review of the Biomass Scenario Model
  - Sponsored a workshop focused on the Social Aspects of Bioenergy Sustainability
  - Integrated sustainability metrics into all technology area design cases and state-of-technology assessments

# BETO Staff



**Alison Goss Eng**



**Zia Haq**



**Alicia Lindauer**



**Kristen Johnson**



**Max Broad**



**Ashley Rose**

# Reviewers

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- Jeremey Alcorn – *Logistics Management Institute*
- Sylvie Brouder – *Purdue University*
- Andras Marton – *Independent ProjectAnalysis, Inc.*
- Shelie Miller – *University of Michigan, School of Natural Resources and Environment*
- John Sheehan – *University of Minnesota, Initiative for Renewable Energy & the Environment*

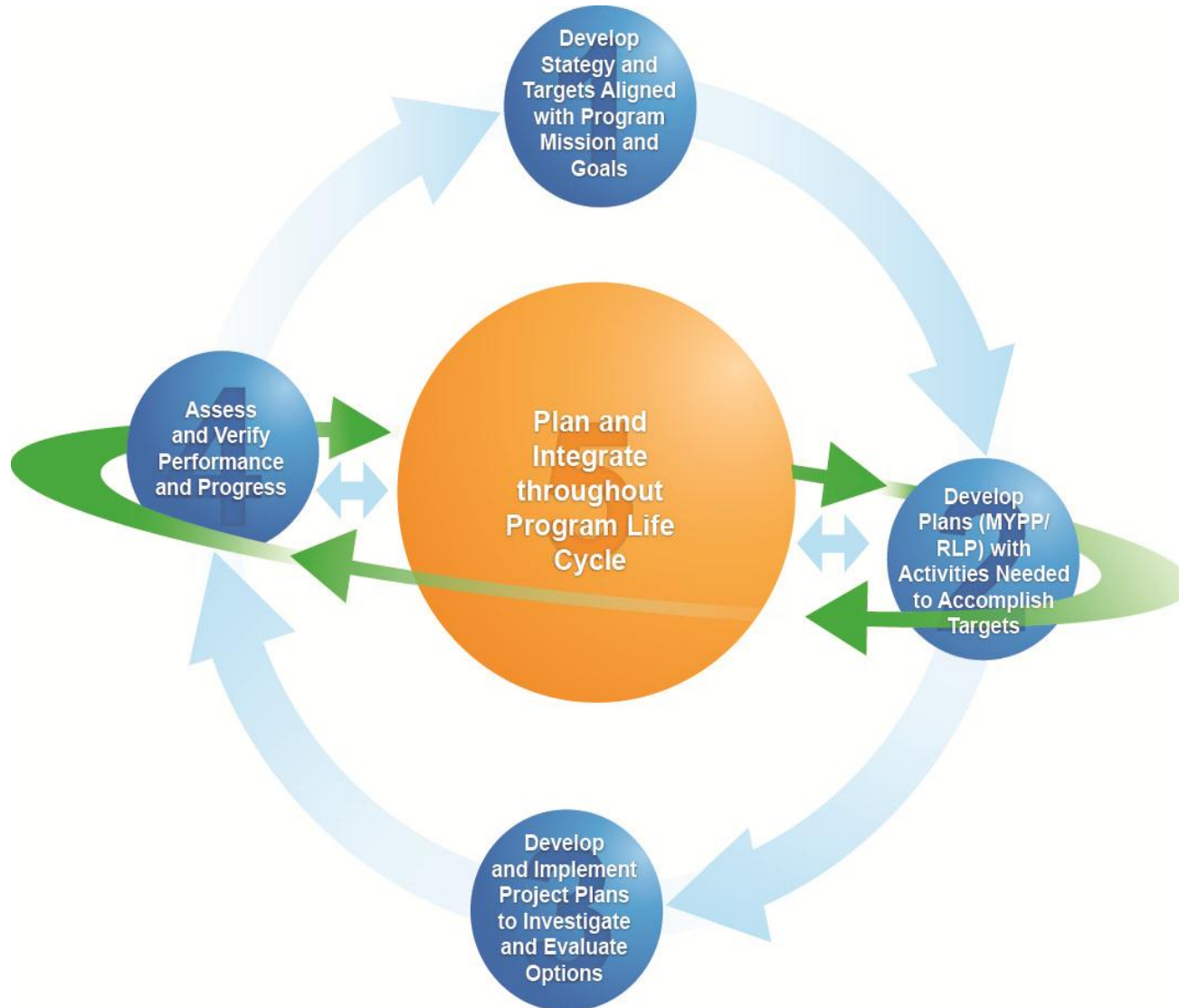
# Backup

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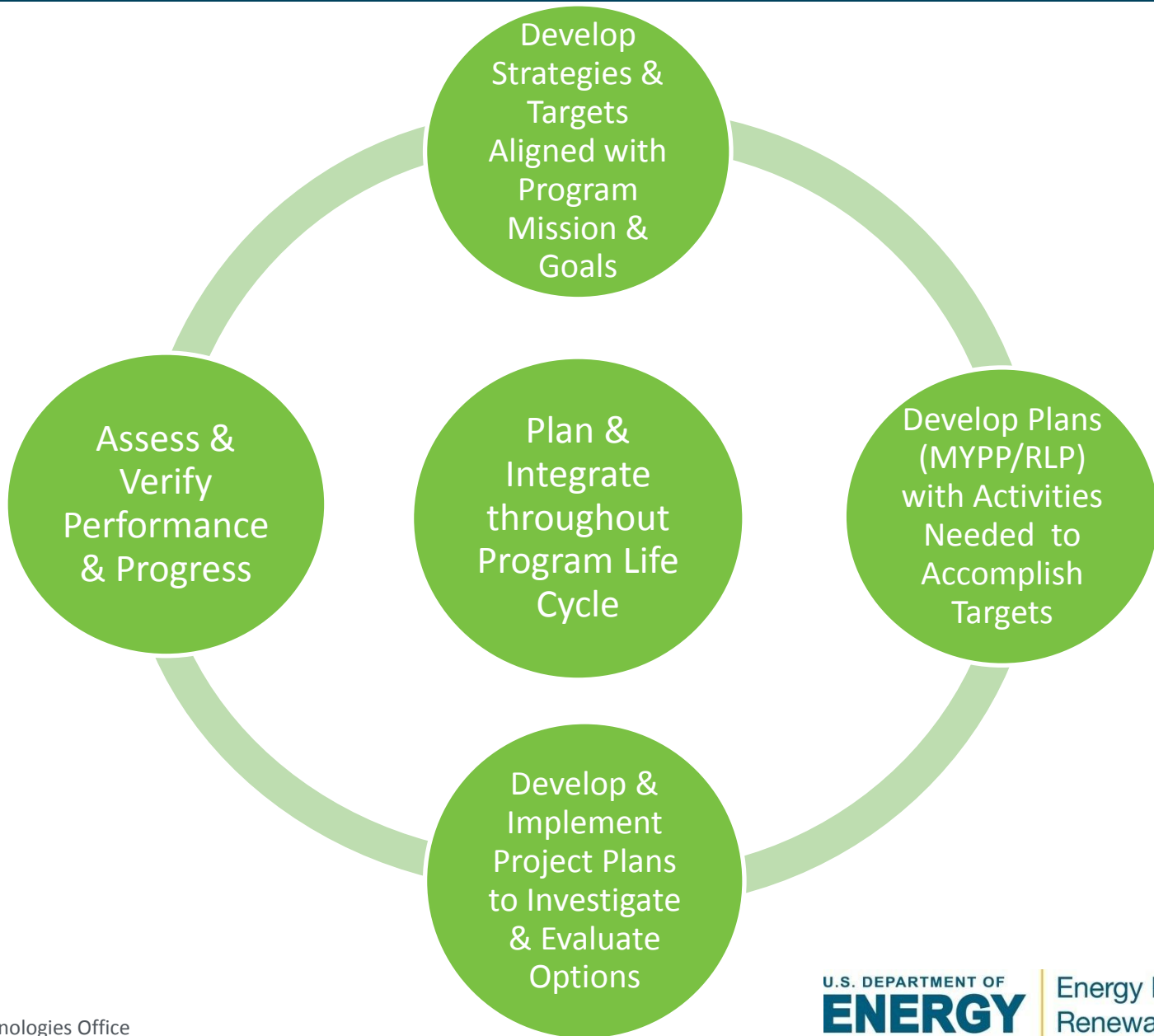
# Extra

- Support BETO decisions
  - Guides program planning functions, portfolio management, R&D project selection and prioritization, and assessment of progress
  - Equips DOE with data, analysis, and expertise to engage in national and global dialogues on bioenergy (e.g., ISO, GBEP, IEA, IPCC)
- Support industry development
  - Provides engineering support for biorefinery development
    - Develops peer reviewed benchmarks to compare against
    - Identifies leverage points and bottlenecks
- Reaching RFS2 volumes requires proactively understanding resource availability and impacts (land, water, GHG emissions)
- Develop beneficial collaborative solutions, and promote appropriate technologies and best practices that enable a viable, large-scale advanced biofuels industry

# Systems Integration



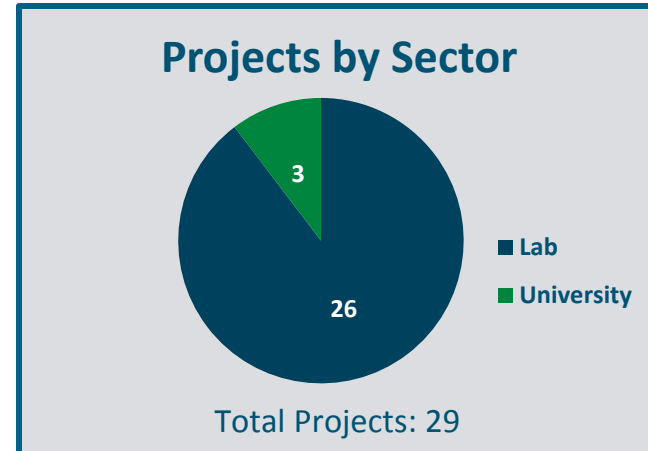
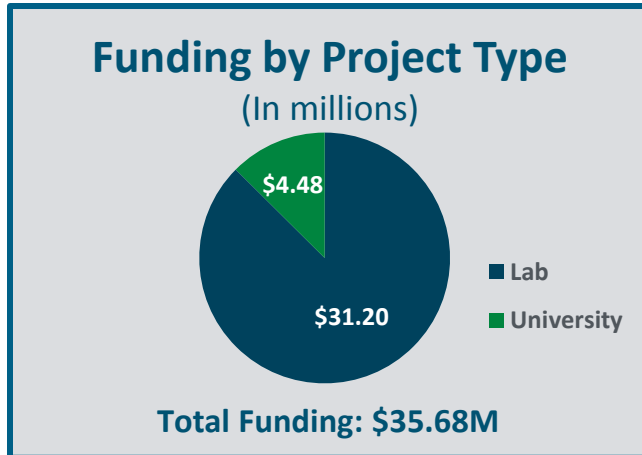
# Systems Integration (*Alternate slide*)



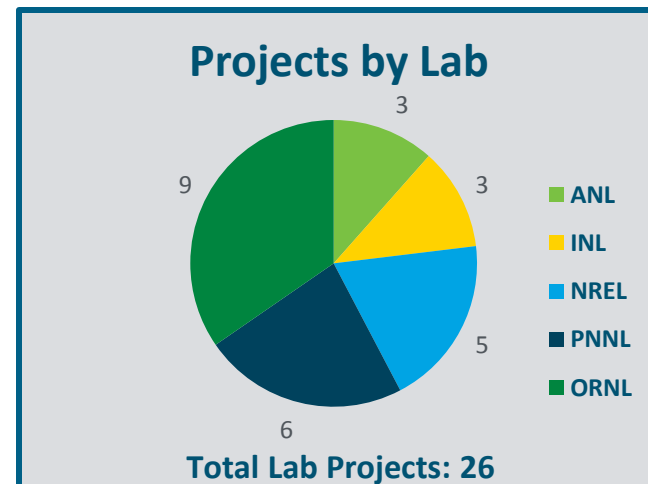
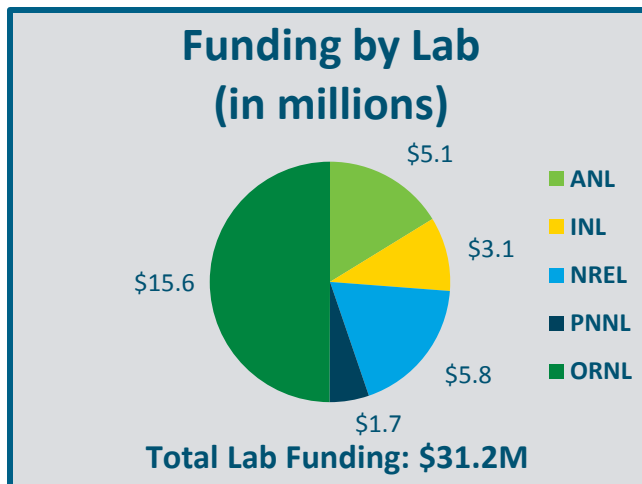


# Budget Information

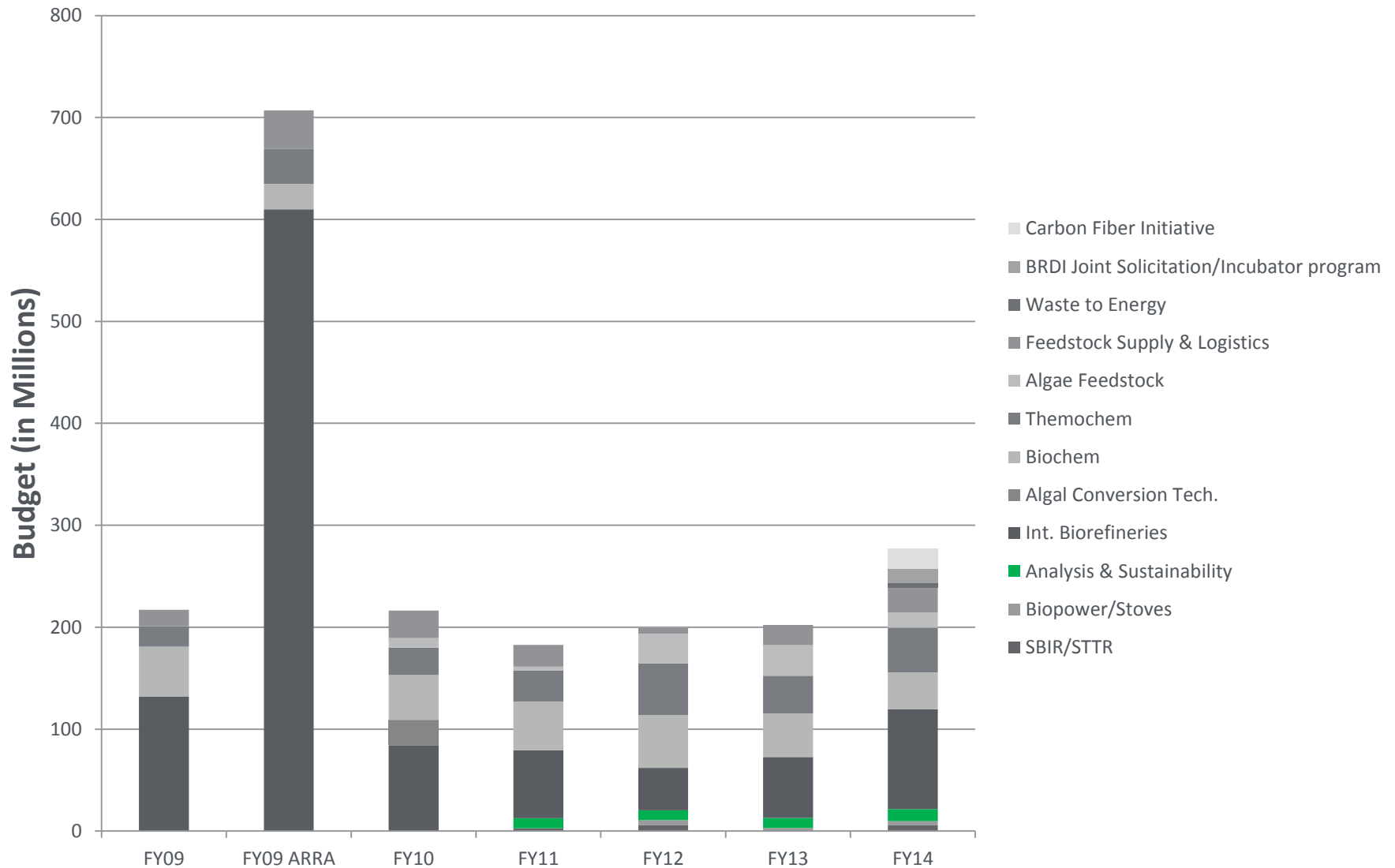
## Breakdown by Project Type



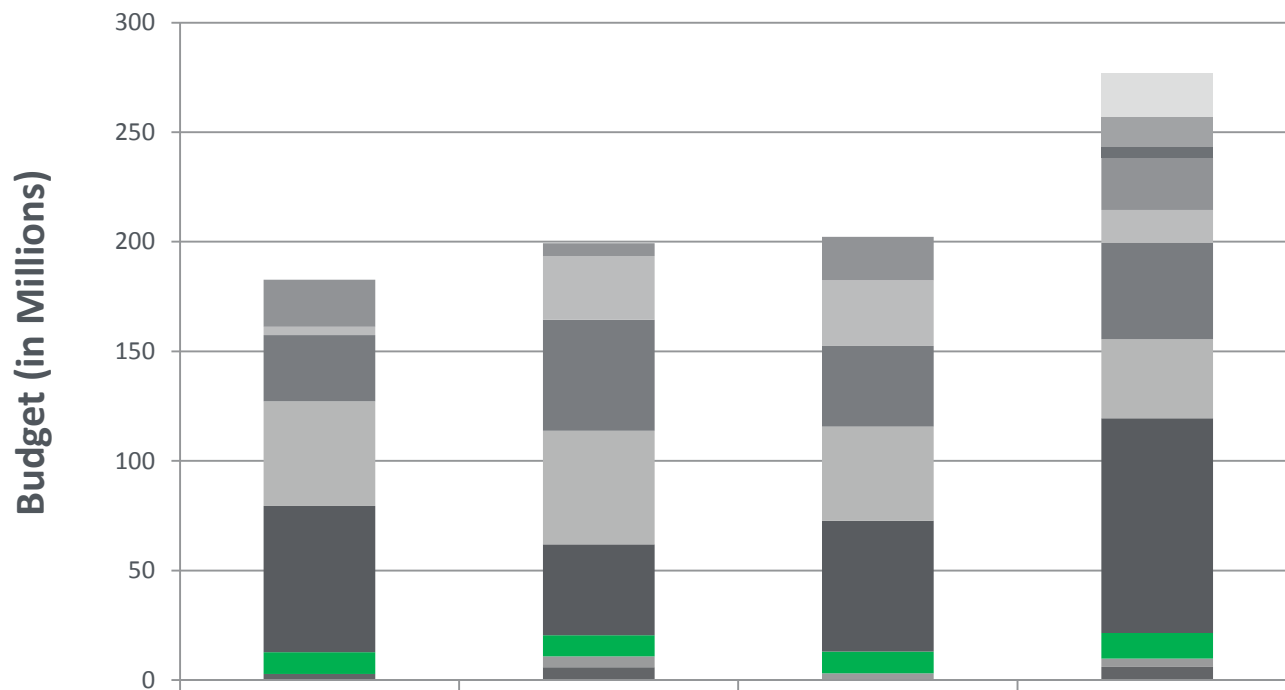
## Breakdown by National Laboratory



# A&S Budget Relative to All Technology Areas

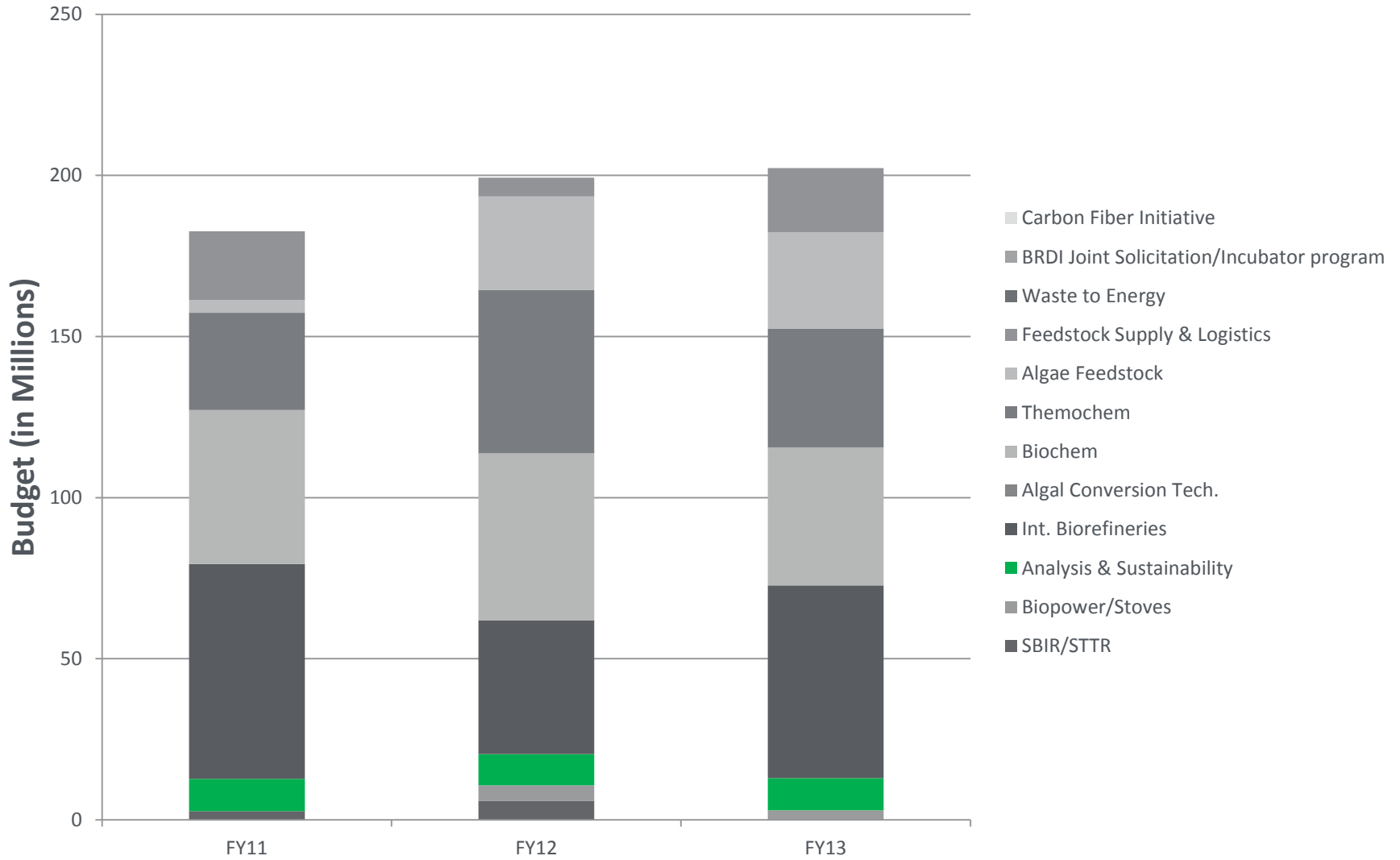


# A&S Budget Relative to All Technology Areas

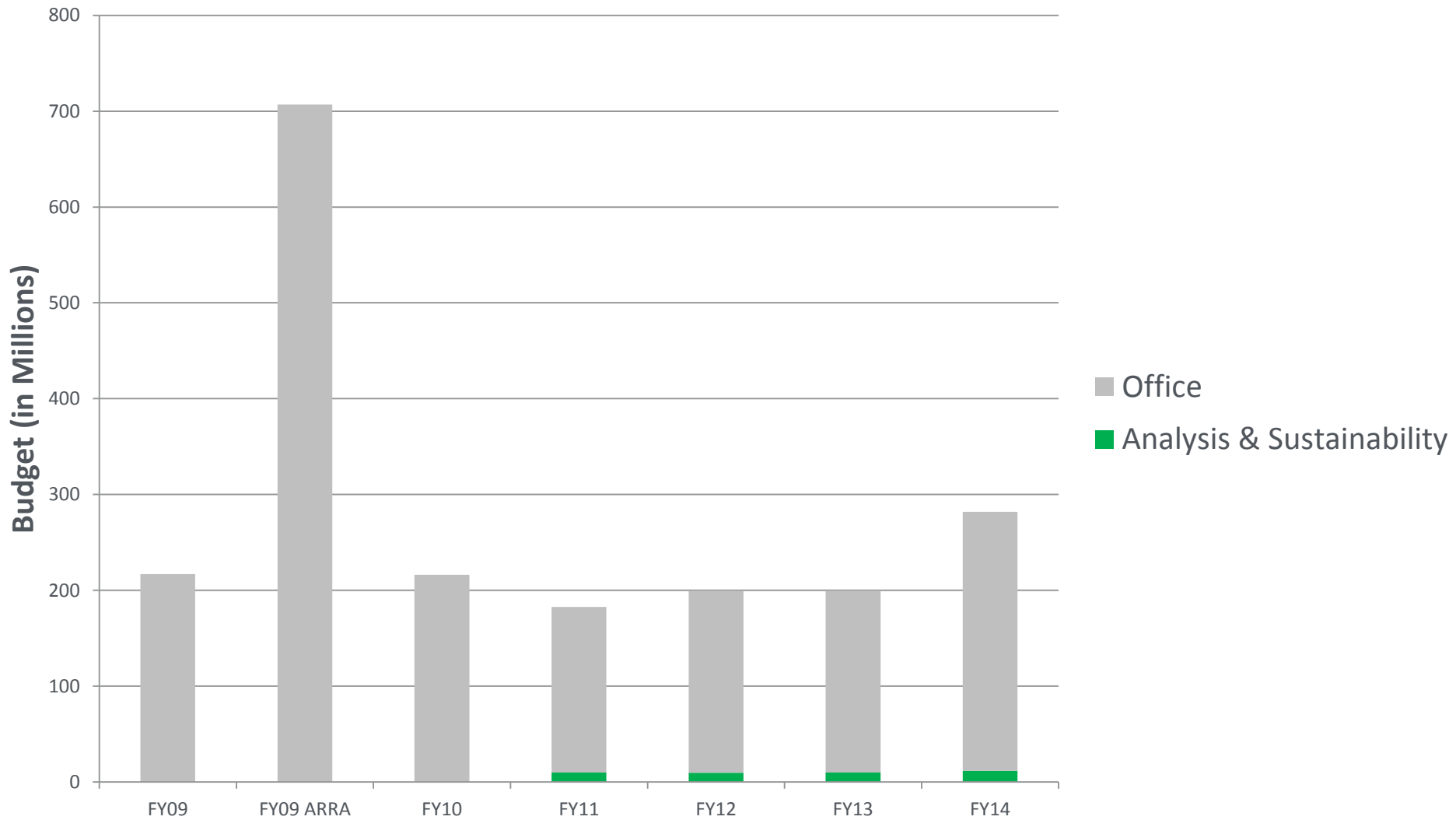


	FY11	FY12	FY13	FY14
Carbon Fiber Initiative	0.0	0.0	0.0	20.0
BRDI Joint Solicitation/Incubator program	0.0	0.0	0.0	13.5
Waste to Energy	0.0	0.0	0.0	5.0
Feedstock Supply & Logistics	21.4	5.8	19.9	24.0
Algae Feedstock	3.9	29.0	29.9	15.0
Themochem	30.2	50.8	36.9	44.0
Biochem	47.8	51.7	42.8	36.0
Algal Conversion Tech.	0.0	0.0	0.0	0.0
Int. Biorefineries	66.7	41.6	59.8	98.0
Analysis & Sustainability	10.0	9.7	10.0	11.8
Biopower/Stoves	0.0	4.8	3.0	3.8
SBIR/STTR	2.7	5.9	0.0	6.0

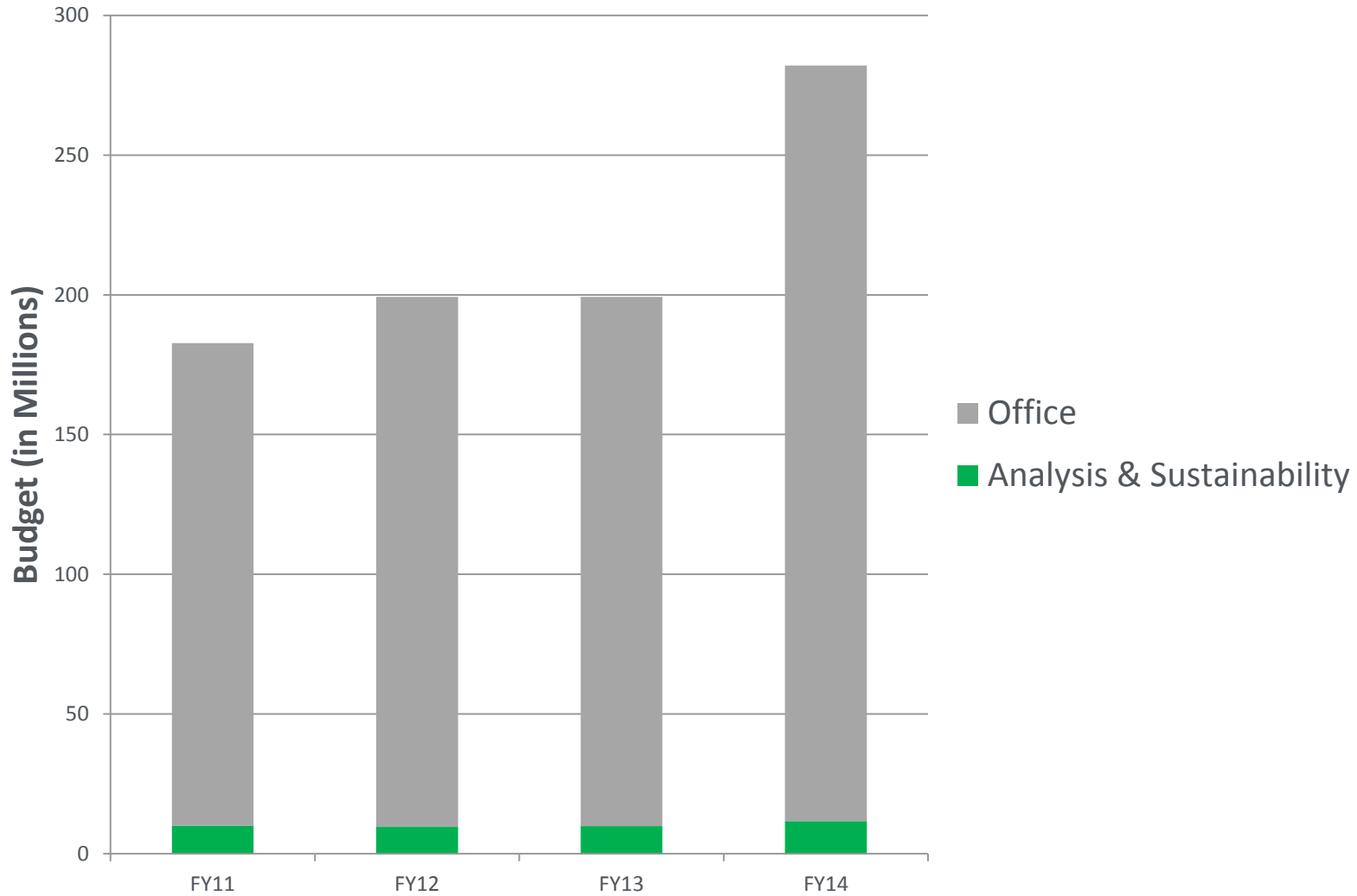
# A&S Budget Relative to All Technology Areas



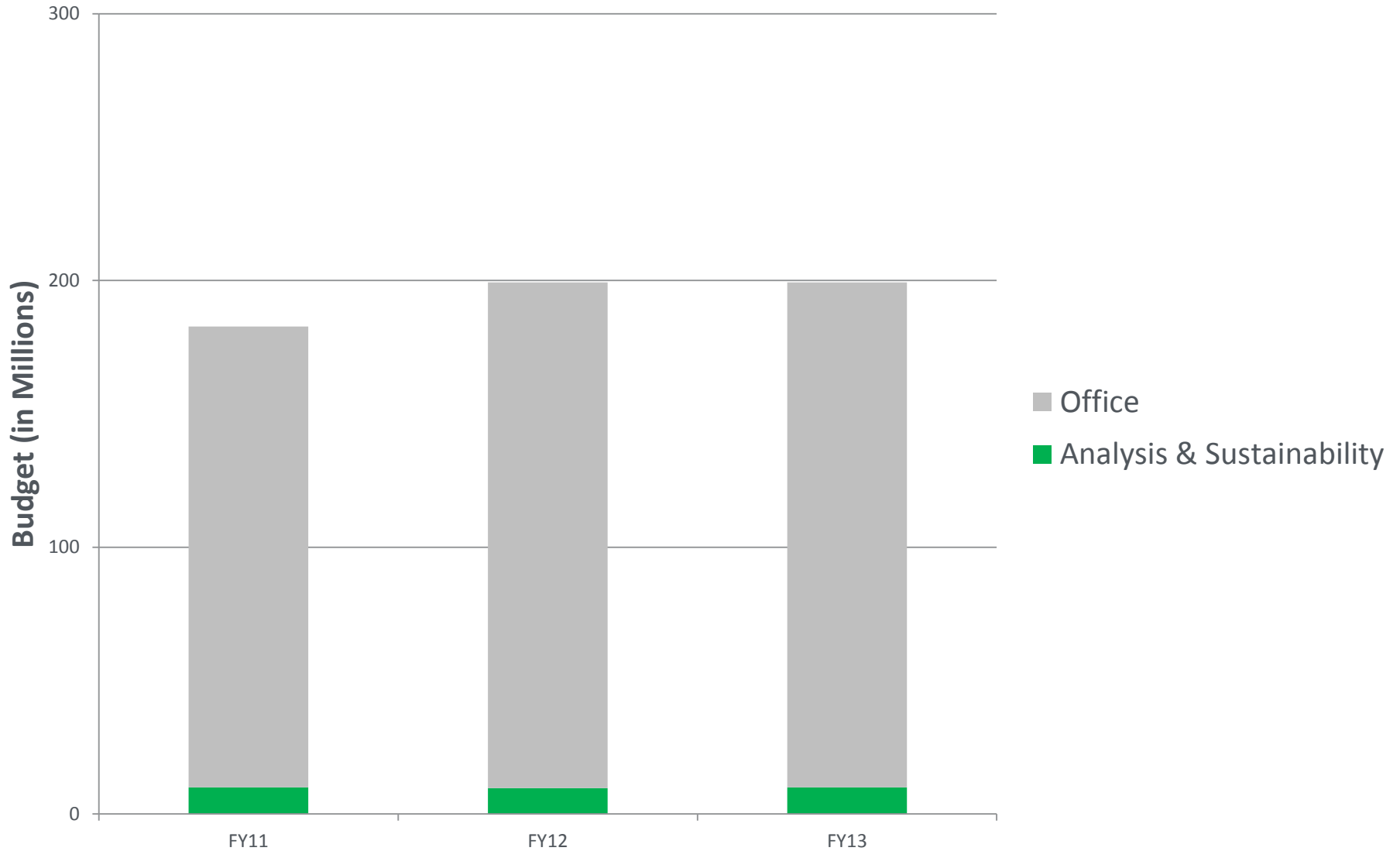
# A&S Budget Relative to Office



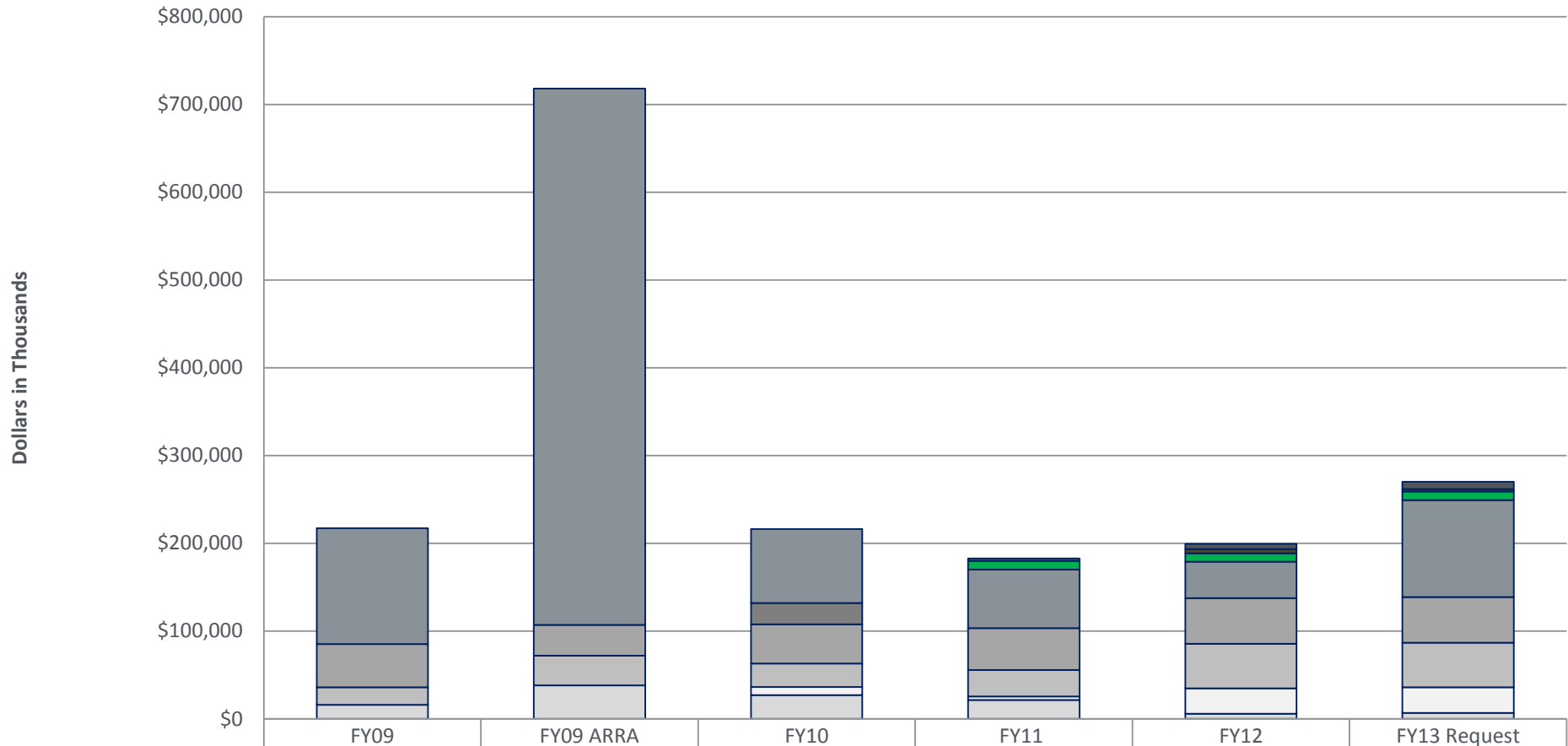
# A&S Budget



# A&S Budget Relative to Office



# Fiscal Year 2009-13 Budget



■ SBIR/STTR				\$2,716	\$5,900	\$8,234
■ Biopower/Stoves					\$4,834	\$2,909
■ Analysis/Sustain				\$10,000	\$9,669	\$9,695
■ Int Biorefineries	\$132,000	\$611,000	\$84,278	\$66,695	\$41,576	\$110,523
■ Algal Conversion Tech.			\$24,465			
■ Biochem	\$49,000	\$35,000	\$44,440	\$47,765	\$51,728	\$51,868
■ Thermochem	\$20,000	\$34,000	\$26,830	\$30,184	\$50,761	\$50,899
□ Algae Feedstock	\$0	\$0	\$9,250	\$3,895	\$29,006	\$29,085
□ Feedstock Infrastructure	\$16,000	\$38,000	\$26,962	\$21,440	\$5,801	\$6,787