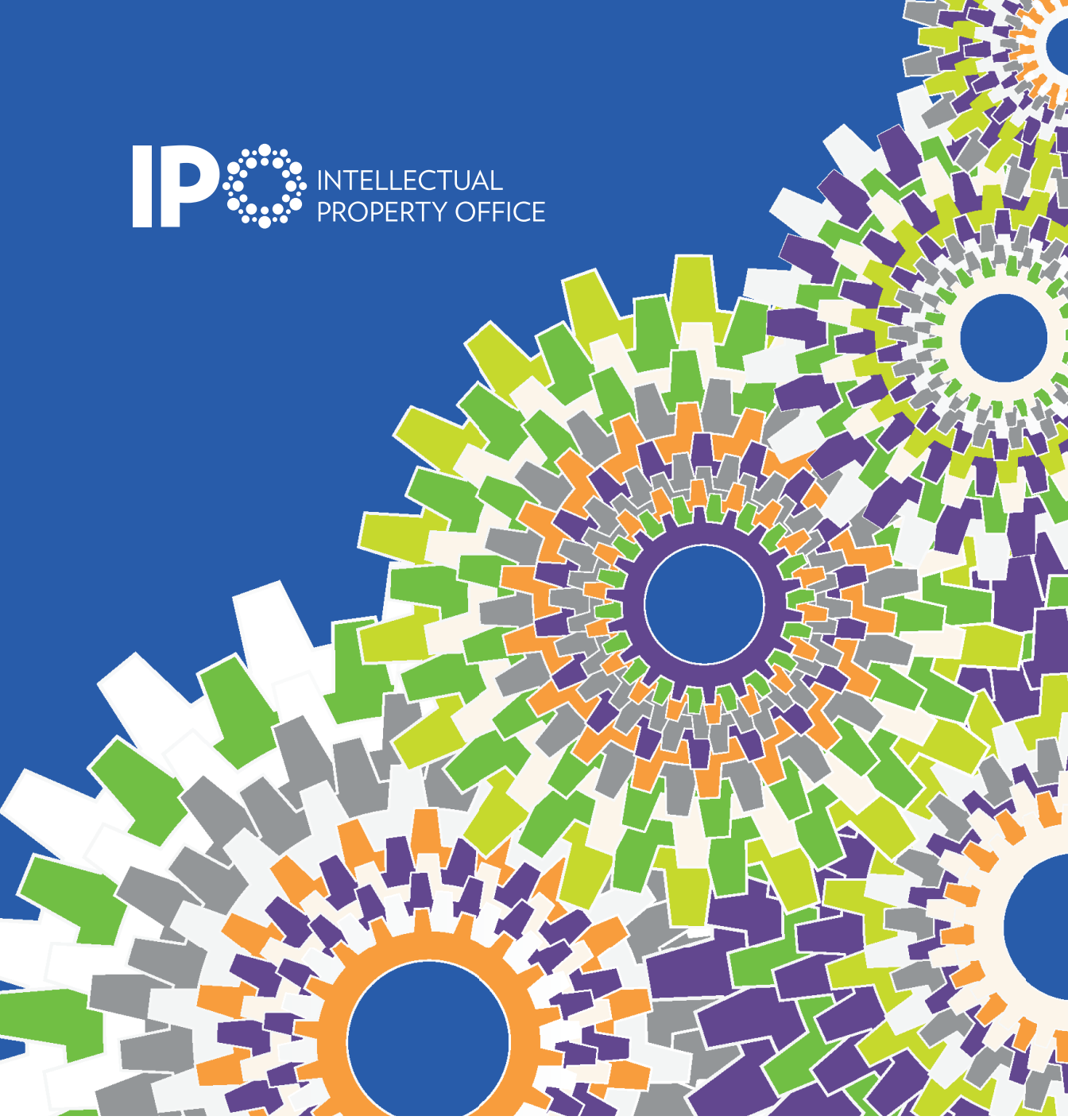


2018 ANNUAL REPORT

BERKELEY LAB

Dr. Elsie Quaite-Randall
Chief Technology Transfer Officer

IPO
INTELLECTUAL
PROPERTY OFFICE

IPO's new and enhanced systems such as the Innovation Portal, facilitate IP protection lab-wide. Multi-lab endeavors such as the Lab-Bridge IP Bundling Project and the Technology Transfer Working Group, expand IPO's reach and knowledge base.

RETURN ON INVESTMENT

The 2018 Department of Energy report, "A Remarkable Return on Investment in Fundamental Research," presents breakthroughs in clean energy, high performance computing and critical materials stemming from DOE's basic science research. Each breakthrough started with a single, novel discovery. While only select new ideas become commercial products, technology transfer offices such as LBNL's Intellectual Property Office work to protect every discovery that could benefit society and the U. S. economy.

Scientific publications and technology licenses are just two examples of technology transfer. IP is shared and industry partnerships are built more typically through non-disclosure agreements (NDAs), material transfer agreements (MTAs), research consortia, and open source software. Our office manages all these tech transfer avenues along with IP Management Plans and Interinstitutional Agreements that make multi-party research projects possible.

IPO's work to handle the day-to-day operations of protecting and transferring LBNL's intellectual property as well as its collaborative projects are highlighted in this 2018 Annual Report. I welcome questions and comments to ipo@lbl.gov.

DOE's National Laboratories play a critical role in addressing the nation's key challenges in energy, security and competitiveness. Because of its five national user facilities and its history of research across disciplines and excellence in team science, Berkeley Lab is continuously developing new technologies that have the potential to make significant impacts on the world.

For Berkeley Lab to deliver its innovative scientific solutions to the nation, strong partnerships with industry are essential. We work with these industry partners to bring Lab inventions, many coming from basic research programs, to the market. The Intellectual Property Office's technology transfer expertise and relationship-building support these essential industry engagements, making it possible for the nation to get the full benefits from our research.

Dr. Michael Witherell
Director
Lawrence Berkeley National Laboratory

IMPROVING TECH TRANSFER OPERATIONS

Successfully moving technologies from the lab into beneficial applications and outcomes requires a great deal of data management and behind-the-scenes evaluation, coordination, and communication – often among multiple stakeholders. *(See the Innovation Cycle diagram on the following pages.)*

IPO introduces new tools and upgraded systems to improve LBNL tech transfer.

Innovation Portal, IPO's paperless and transparent system, facilitates new technology and software disclosures and collaborative agreement (NDA, MTA) requests.

DocuSign coordinates signature collection for multi-inventor licenses and contracts.

Determine, a platform for document management, ensures consistent, accurate agreement templates and clauses.

Web-based CPI enables IPO staff to manage intellectual property from any computer.

Marketplace website offers LBNL-developed commercial and open-source software for purchase or free download.

Quid, an intellectual property analysis tool, supports industry partner matching and outreach.

IPO negotiates agreements required to activate millions of dollars in research funding.

Cooperative Research and Development Agreements (CRADAs) facilitate startup cohorts in Berkeley Lab's **Cyclotron Road** incubator and industry partnerships in **CalCharge**, the Lab's battery research consortium.

Strategic Partnership Projects (SPPs) enable industry to use LBNL's unique facilities and expertise.

Intellectual Property Management Plans (IPMPs) and **Interinstitutional Agreements (IIAs)** provide a framework for shared discoveries resulting from multi-party collaborations.

IPO supports LBNL researchers interested in startups and elevates tech transfer across all DOE national labs.

Berkeley Lab Innovation Corps (BLIC) presents expert speakers, funding news and networking opportunities to the Lab's entrepreneurial researchers.

DOE Energy I-Corps (formerly Lab-Corps) and **NSF I-Corps** educate Berkeley Lab researchers in customer discovery and business modeling.

Technology Transfer Working Group establishes tech transfer best practices to expand the societal and economic impact of all DOE national labs.

DOE's **Lab Partnering System** and **LabBridge Projects** align national lab expertise and IP with industry needs to advance U. S. innovation.

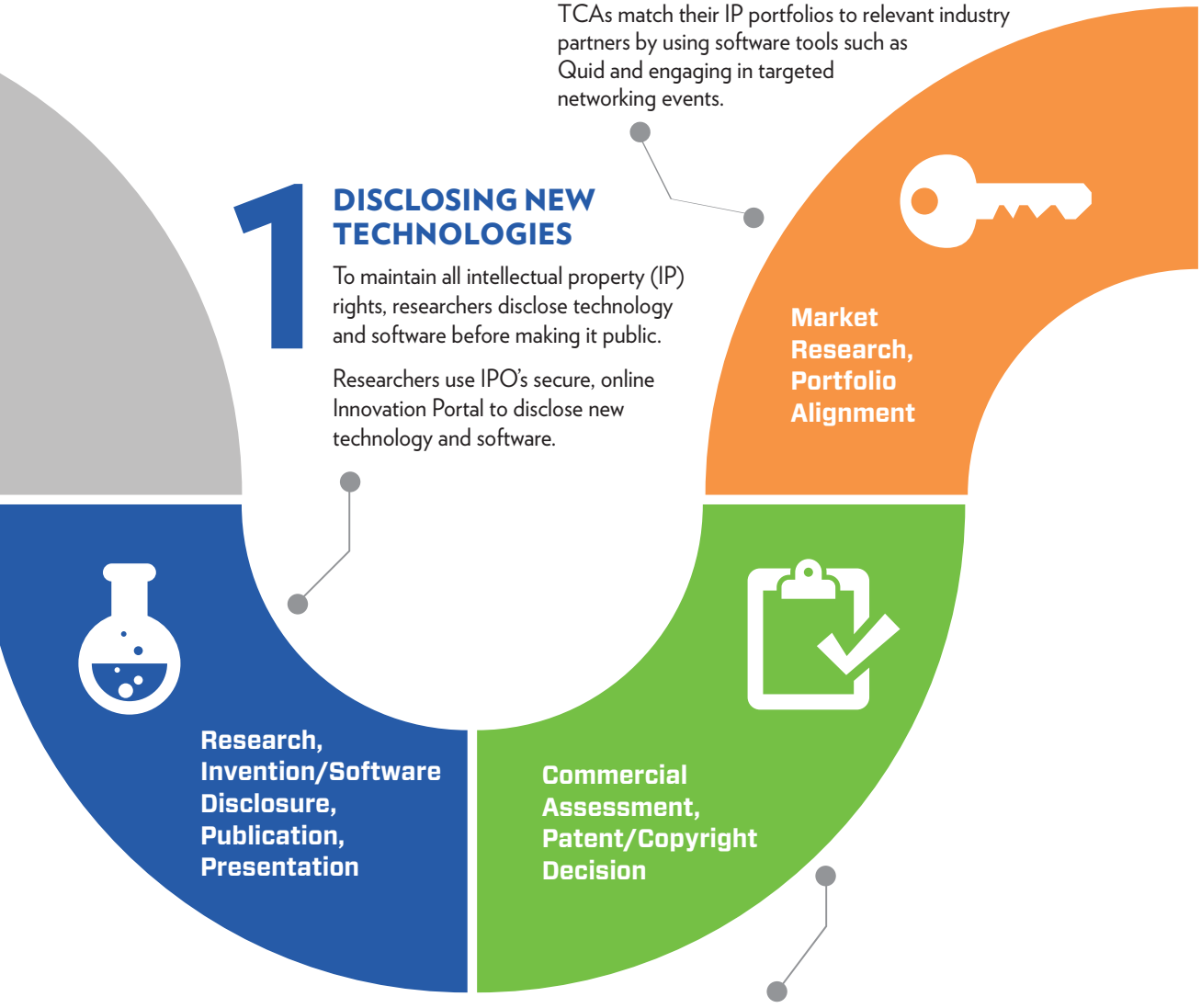
FROM LAB TO MARKET

THE INNOVATION CYCLE

3 IDENTIFYING MARKETS

By developing IP portfolios, TCAs can demonstrate multiple technologies across many research areas to companies with broad interests.

TCAs match their IP portfolios to relevant industry partners by using software tools such as Quid and engaging in targeted networking events.



1 DISCLOSING NEW TECHNOLOGIES

To maintain all intellectual property (IP) rights, researchers disclose technology and software before making it public.

Researchers use IPO's secure, online Innovation Portal to disclose new technology and software.

2 ASSESSING AND PROTECTING IP

New technology without significant commercial markets can still be transferred to society through publications, presentations, and open source software.

Technology Commercialization Associates (TCAs) align IP protection investment and efforts with science area goals and research strengths.

4 NURTURING PARTNERSHIPS

IP Management Plans (IPMPs) and Interinstitutional Agreements (IIAs) are required before multi-party inventions and collaboration can move forward.

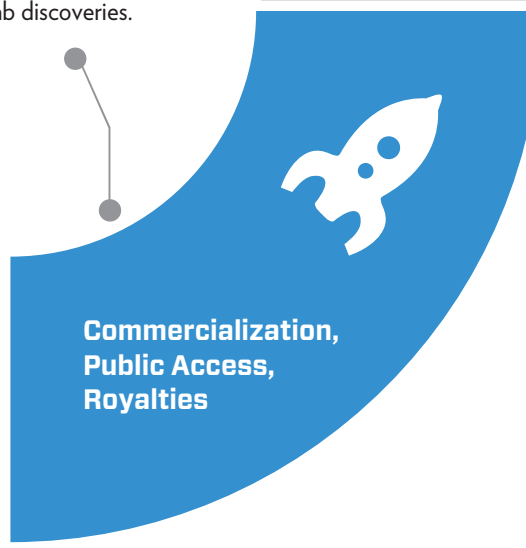
IPO supports lab-to-market training and expert speaker events for Berkeley Lab researchers interested in pursuing startups.

Available technologies are promoted on IPO's website, DOE's Lab Partnering Service, and at national conferences.

6 ADVANCING TECHNOLOGY

Innovation reaches society and the marketplace through publications, open source software distribution and technology maturation research in addition to licensed inventions and startups.

Royalties generated by licensed Berkeley Lab inventions and software are invested into new Berkeley Lab discoveries.



5 NEGOTIATING AGREEMENTS

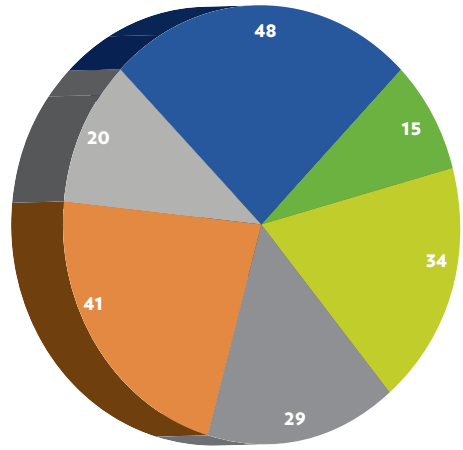
Licenses, User Agreements, CRADAs and SPPs are the mechanisms that connect industry and other research partners with Berkeley Lab's unique inventions, software, expertise and state-of-the-art facilities, to advance innovation.

Industry partners perform defined projects using LBNL's unique facilities and expertise under an agreement called a Strategic Partnership Project (SPP).

FY17 Strategic Partnership Projects (SPPs) by Research Area

Biosciences:	48	$ 15,597,476
Computing Sciences:	15	$4,491,598
Earth and Environmental Sciences:	34	$ 9,570,100
Energy Sciences:	29	$ 9,648,497
Energy Technologies:	41	$ 10,542,011
Physical Sciences:	20	$ 4,811,134

TOTAL: 187
TOTAL VALUE: $ 54,660,816

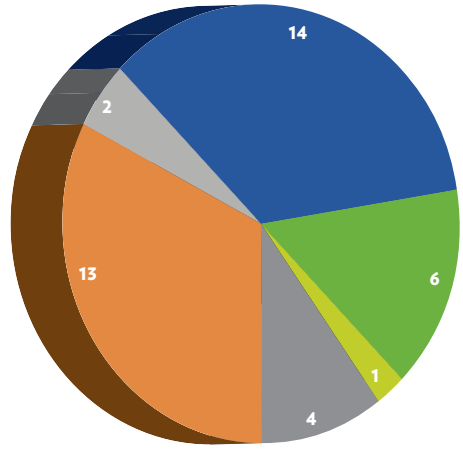


Lawrence Berkeley National Laboratory and industry partners jointly sponsor research for shared benefit under a Cooperative Research and Development Agreement (CRADA).

FY17 Cooperative Research and Development Agreements (CRADAs) by Research Area

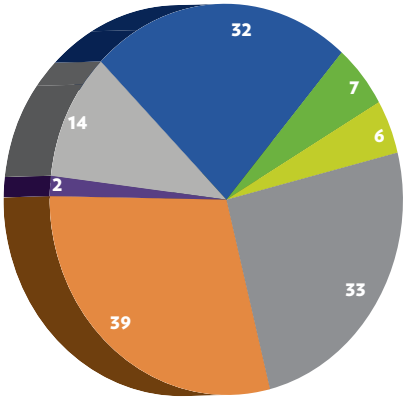
Biosciences:	14	$ 2,296,379
Computing Sciences:	6	$ 2,004,372
Earth and Environmental Sciences:	1	$ 160,000
Energy Sciences:	4	$ 2,023,600
Energy Technologies:	13	$ 2,156,356
Physical Sciences:	2	$ 460,419

TOTAL: 40
TOTAL VALUE: $ 9,101,126



Lawrence Berkeley National Laboratory researchers who believe they have invented something unique disclose their inventions to the Lab's Intellectual Property Office (IPO). Computer software intended to be distributed outside the lab is also disclosed to IPO.

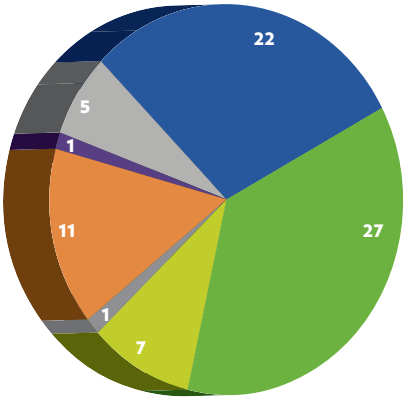
FY17 Invention Disclosures by Research Area



TOTAL: 133

- Biosciences: 32
- Computing Sciences: 7
- Earth and Environmental Sciences: 6
- Energy Sciences: 33
- Energy Technologies: 39
- Operations: 2
- Physical Sciences: 14

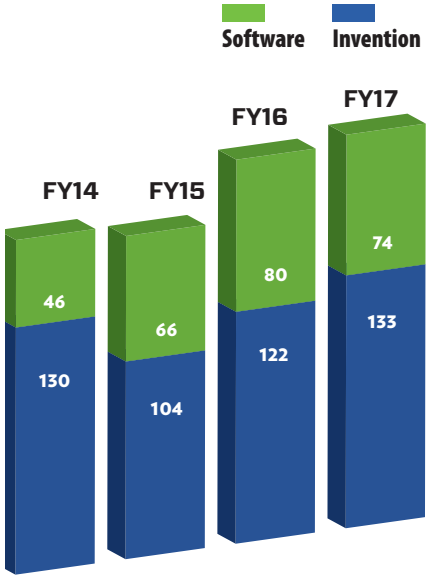
FY17 Software Disclosures by Research Area



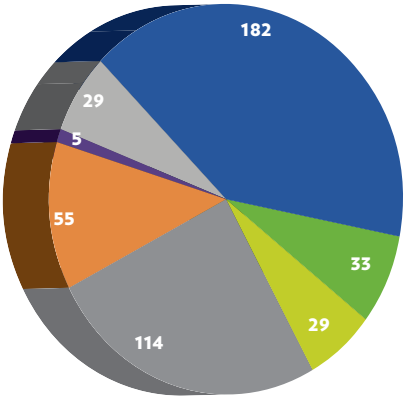
TOTAL: 74

- Biosciences: 22
- Computing Sciences: 27
- Earth and Environmental Sciences: 7
- Energy Sciences: 1
- Energy Technologies: 11
- Operations: 1
- Physical Sciences: 5

Disclosures: 4 Year Trend



FY17 Technologies Assessed by Research Area



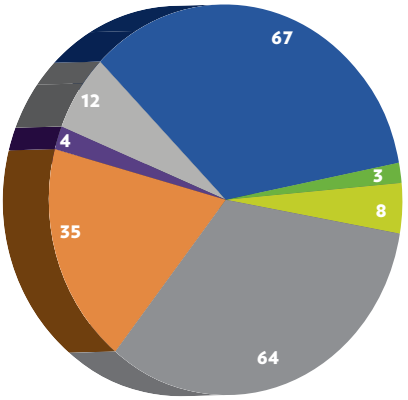
TOTAL: 406*

- Biosciences: 182
- Computing Sciences: 33
- Earth and Environmental Sciences: 29
- Energy Sciences: 114
- Energy Technologies: 55
- Operations: 5
- Physical Sciences: 29

*Sum of area values exceeds lab-wide total due to technologies with multiple inventors from different areas.

Filing patent applications on novel, useful, and non-obvious inventions makes them more attractive to potential industry partners and ensures LBNL and its researchers receive credit and a fair return once inventions are commercialized.

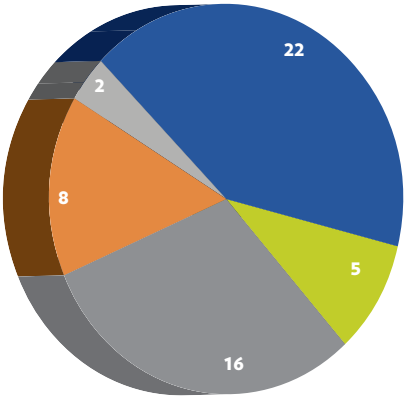
FY17 Patent Applications Filed by Research Area



TOTAL: 193

- Biosciences: 67
- Computing Sciences: 3
- Earth and Environmental Sciences: 8
- Energy Sciences: 64
- Energy Technologies: 35
- Operations: 4
- Physical Sciences: 12

FY17 Patents Issued by Research Area



TOTAL: 53

- Biosciences: 22
- Computing Sciences: 0
- Earth and Environmental Sciences: 5
- Energy Sciences: 16
- Energy Technologies: 8
- Operations: 0
- Physical Sciences: 2

IPO's patent attorneys and technology commercialization associates work together to identify potential markets and partners for new inventions and software and to determine next steps for patent or copyright protection.

IP Management Plans

An Intellectual Property Management Plan (IPMP) is established to manage IP expected to be created under a single research award involving multiple parties—universities, private companies, and/or other DOE national labs. Without the IPMP in place, the research project is not funded and work cannot begin.

In FY17, IPO negotiated five IPMPS, each with an average of four parties, to enable nearly $9M in research funding into Lawrence Berkeley National Laboratory.

Interinstitutional Agreements

An Interinstitutional Agreement (IIA) is negotiated between partners who jointly own IP to manage patent filing and prosecution as well as future licensing of the IP.

In FY17, IPO developed nine IIAs with universities and research institutions, ensuring that research in batteries, therapeutics, climate models, and energy efficient building technologies can ultimately reach society and the marketplace.

Industry partners from small businesses and startups to multinational companies license LBNL technology and software to commercialize for the marketplace.

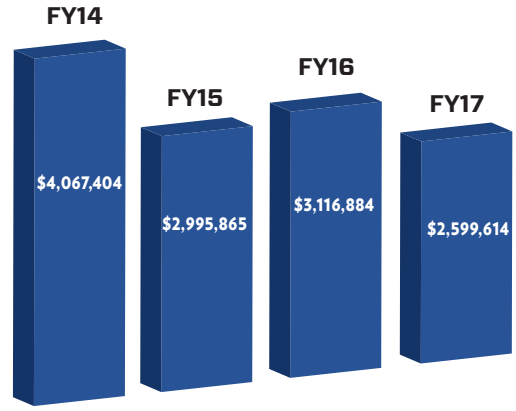
Licensed technologies generate royalties for Berkeley Lab. For inventions disclosed after September 30, 1997, 35% of the net income from royalties—after reimbursing patenting costs or copyright registration fees—goes to the inventors, 15% goes to the research division where the invention originated, and 50% supports future lab research.

FY17 License Agreements*

*Some agreements include multiple invention or software licenses

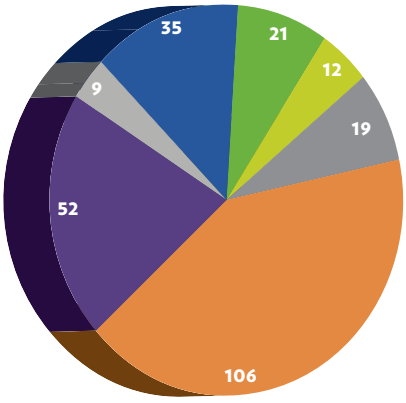
LICENSE TYPE:	
Bailment	3
Invention License	5
CRADA Option	2
Option	8
Software	206

Royalties: 4 Year Trend



Non-Disclosure Agreements are requested by Lab researchers and / or potential industry partners to protect information they may discuss. **Material Transfer Agreements** are required when Lawrence Berkeley National Laboratory and its partners **share research materials** for evaluation.

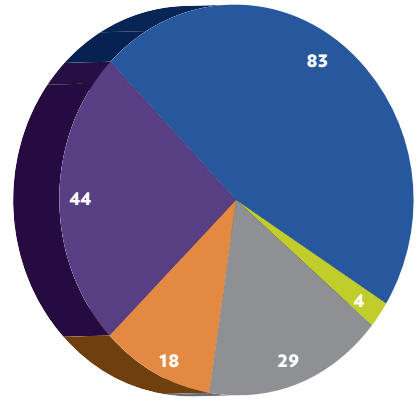
FY17 Non-Disclosure Agreements by Research Area



TOTAL: 254

- Biosciences: 35
- Computing Sciences: 21
- Earth and Environmental Sciences: 12
- Energy Sciences: 19
- Energy Technologies: 106
- Operations: 52
- Physical Sciences: 9

FY17 Material Transfer Agreements by Research Area



TOTAL: 178

- Biosciences: 83
- Computing Sciences: 0
- Earth and Environmental Sciences: 4
- Energy Sciences: 29
- Energy Technologies: 18
- Operations: 44
- Physical Sciences: 0


PORTFOLIOS
WATER TREATMENT
INDUSTRIAL BIOTECH
SUBSURFACE SIMULATION
BUILDING CONTROLS
WIND
MACHINE LEARNING / AI
AIR QUALITY MONITORING
ARTIFICIAL PHOTOSYNTHESIS
SEMICONDUCTORS
BIG DATA
CYBER SECURITY
BATTERY MATERIALS
COMPUTATIONAL BIO
HIGH ENERGY PARTICLES
SOLAR
SCINTILLATORS
ENERGY EFFICIENCY
ACCELERATORS
THE GRID
IMAGING
COMPUTER NETWORKS
MICROBES 2 BIOMES
THERAPEUTICS
FUEL CELLS

PORTFOLIOS

Inventions, software and expertise grouped by scientific approach or commercial application

In FY17, IPO's Technology Commercialization Associates developed portfolios of LBNL technologies* grouped by scientific field or commercial application. The IP Portfolios, represented on p.10, enable IPO to highlight Lab strengths and identify more industry partners, ultimately advancing technology transfer.

MULTI-LAB PORTFOLIOS

IPO led DOE's Lab Bridge IP Bundling Project in which six DOE national labs contributed IP to create bundled, multi-lab technology solutions to meet specific industry needs. The project identified synergies in expertise and capabilities across national labs and created a scalable IP bundling process combining automation with human expertise. The project team also developed a common interinstitutional agreement to serve as a model for future multi-lab/industry partnerships.

*** issued patents, patent applications in active prosecution, disclosures in assessment, commercial software and open source software**

FY17 STARTUPS BY PORTFOLIO

AIR QUALITY MONITORING: Micro Gas Safety Systems licensed a nanoparticle-based gas sensor to detect the presence of toxic hydrogen sulfide, common in the oil and gas industry.

BATTERY MATERIALS: NexTech Batteries licensed LBNL battery technologies to develop safe, high performance, recyclable, and rechargeable Lithium-Sulfur batteries for use in aviation, transportation, and wearables.

IMAGING: Newomics licensed a multinozzle emitter array for on-chip mass spectrometry. The technology speeds sensitive identification of biological samples by researchers seeking to cure or manage disease. Newomics sold its first product, the M3 Emitter, in FY18.

FY17 KEY LICENSEES

SUBSURFACE SIMULATION: The Lab's **TOUGH** software modules and tools, simulators applied to geothermal reservoirs and other applications, generated 187 licenses.

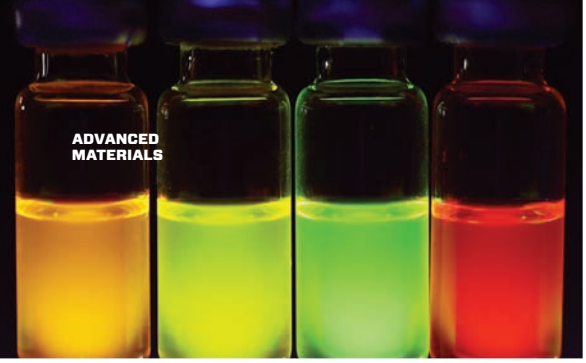
BUILDING CONTROLS: DER-CAM, an economic and environmental modeling software for distributed energy resources, was licensed to nine users.

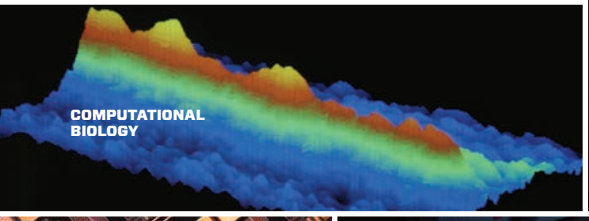
COMPUTATIONAL BIOLOGY: PHENIX and **LABELIT,** supporting computational crystallography to speed development of drug treatments, were licensed to 33 users.

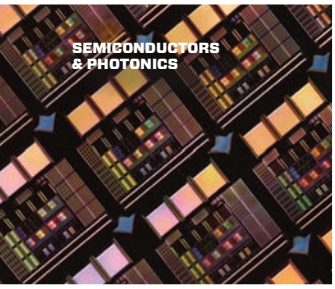
ENERGY EFFICIENCY: Home Energy Saver APIs, guiding energy efficient building material and appliance selection, were licensed by 16 users.

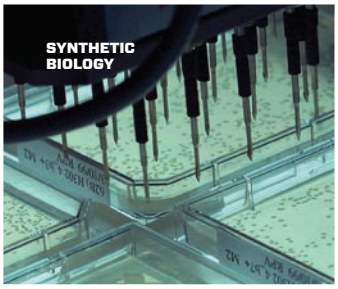
WATER TREATMENT: Kanomax licensed a particulate sensor technology to develop a low cost, portable pollutant (PM 2.5, PM 10) monitoring device.

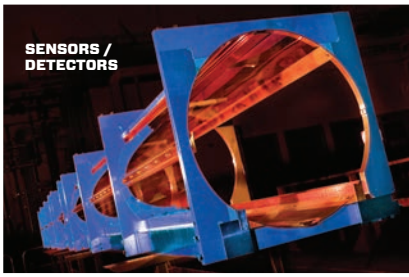
THERAPEUTICS: IPO licensed **mouse models** to organizations researching sickle cell disease and coronary artery disease.

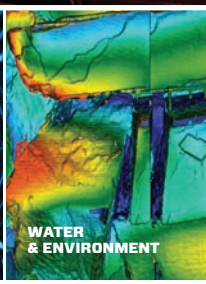












LAWRENCE BERKELEY NATIONAL LABORATORY EXPERTISE

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