



# INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.



U.S. DEPARTMENT OF  
**ENERGY**



# INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

## Program Overview



U.S. DEPARTMENT OF  
**ENERGY**

Oak Ridge National Laboratory is managed by UT-Battelle for the U.S. Department of Energy.

Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.



# LEEP Premise and Vision

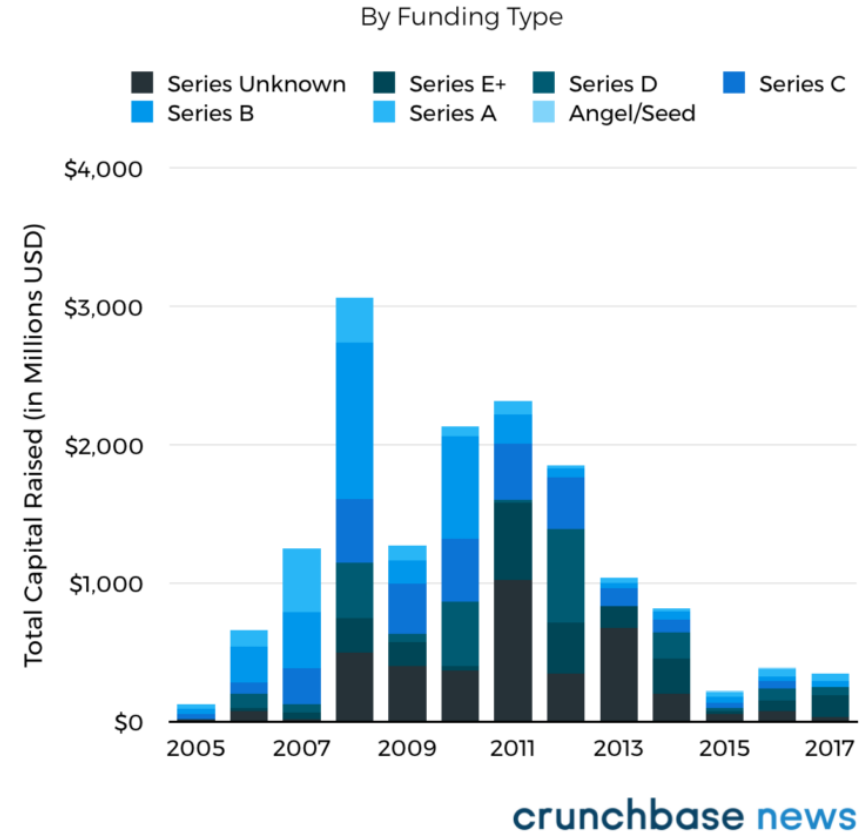
- **Premise:**

- Hardware-based startups are challenging
  - Require technical and business expertise
  - Capital intensive
- Early stage VC funding is decreasing

- **Vision:**

1. **Recruit** the best energy technology innovators
2. **Leverage** expert mentorship and world-class facilities at national labs on a win-win basis
3. **Position** people and technology for market

## VC Funding Into U.S. Cleantech Startups



cyclotronroad

2015

INNOVATION  
CROSSROADS

2017

CHAIN REACTION  
INNOVATIONS

2017

INNOVATION  
CROSSROADS



# Accelerating Innovation by Embing Entrepreneurs at ORNL

- Innovation Crossroads, located at Oak Ridge National Laboratory, is the Southeast's only entrepreneurial research and development program based at a U.S. Department of Energy national laboratory.
- Innovation Crossroads, supported by Oak Ridge National Laboratory, the US Department of Energy's Advanced Manufacturing Office, and Tennessee Valley Authority, is an innovation program that serves as a platform for supporting and mentoring entrepreneurial researchers whose early-stage innovations are presently too challenging or technically uncertain to pursue in a venture capital-financed startup.
- Innovation Crossroads embeds innovators at Oak Ridge National Laboratory for up to two years through entrepreneurial mentorship and cooperative research and development. This unique fellowship opportunity allows selected innovators to leverage the Labs unique scientific facilities, equipment, capabilities, and experts to advance their early stage scientific discoveries into potentially commercializable opportunities within an accelerated time period.



# Sponsors and Impact Areas

## Sponsors



## Impact Areas



### Clean Energy & Global Security

Mission: Deliver scientific discoveries and technical breakthroughs that will accelerate the development and deployment of solutions in clean energy and global security.



### Energy & Advanced Manufacturing

Mission: Catalyze research, development and adoption of advanced manufacturing technologies and practices to drive U.S. economic competitiveness and energy productivity.



### Integrated Grid

Mission: Support investments in technologies to achieve an integrated grid: a power system that is highly flexible, resilient, and connected and that optimizes energy production, delivery, and use.

# How We Support Our Innovators

- **A two-year fellowship** – Innovators receive a yearly living stipend of \$78,900 to \$89,000, along with a health insurance stipend and travel allowance.
- **Lab access and research funding** – In addition to unparalleled access to facilities, research tools, equipment, and expertise at Oak Ridge National Laboratory, innovators receive R&D funding to support collaboration opportunities with researchers across the lab.
- **Business mentors, entrepreneurial training, and networking** – Innovators receive access to experienced business mentors, entrepreneurial training programs, and exclusive networking opportunities. Innovators are also exposed to a wide range of leaders from academia, industry, government, and finance that can serve as advisors and partners.





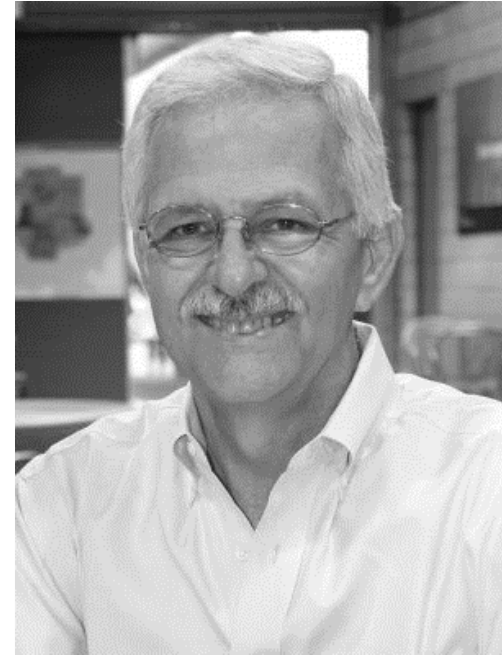
# ORNL's Innovation Crossroads Team



**Dan Miller**  
Program Lead



**Kelly Wampler**  
Business Specialist



**Gary Rawlings**  
Technology Consultant

# Internal Advisory Board

- **Suresh Babu** – Governor Chair, ORNL
- **Craig Blue** – Program Manager, Advanced Manufacturing, ORNL
- **Claus Daniel** – Director, Applied Energy Programs, ORNL
- **Sean Gleason** – Division Director, Cyber and Applied Data Analytics
- **Sean Hearne** – Division Director, Materials Science and Technology, ORNL
- **Moe Khaleel** – Deputy for Projects, Office of the Laboratory Director, ORNL
- **Tom King** – Program Director, Sustainable Electricity Program, ORNL
- **Jeff Nichols** – Associate Laboratory Director, Computing and Computational Sciences
- **Jennifer Palmer** – Business Development and Strategic Initiatives, Energy and Environmental Sciences, ORNL
- **Parans Paranthaman** – Group Leader, Materials Chemistry, ORNL
- **Mike Paulus** – Director, Technology Transfer, ORNL
- **Yarom Polsky** – Group Leader, Sensors and Embedded Systems, ORNL
- **Tom Rogers** – President and CEO, University of Tennessee Research Park at Cherokee Farm
- **Xin Sun** – Division Director, Energy and Transportation Science
- **Stan Wullschleger** – Interim Associate Laboratory Director, Energy and Environmental Sciences, ORNL





# Leadership Council: A National Network of Visionaries

- **Jason Blumberg**, *Energy Foundry*
- **John Bruck**, *Anderson Center for Entrepreneurship and Innovation, University of Tennessee*
- **Doug Buerkle**, *LTM Ventures*
- **Aaron Chockla**, *True North Ventures*
- **Jonathan Goldman**, *Georgia Tech VentureLab*
- **Alison Gotkin**, *United Technologies Research Center*
- **Kate Kornau**, *Eastman Chemical Company*
- **Paul Leggett**, *Mithril Capital Management*
- **Eric McFarland**, *University of California, Santa Barbara*
- **Stacey Patterson**, *University of Tennessee*
- **Sanjiv Malhotra**, *SPARKZ Inc.*
- **Vig Sherrill**, *General Graphene*
- **Mary Anne Sullivan**, *Hogan Lovells*
- **Van Tucker**, *Launch Tennessee*
- **Grady Vanderhoofven**, *Three Roots Capital*
- **Johanna Wolfson**, *PRIME Impact Fund*
- **Jetta Wong**, *LA Cleantech Incubator*
- **Peter Winer**, *In-Q-Tel*



# INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

## Program Metrics

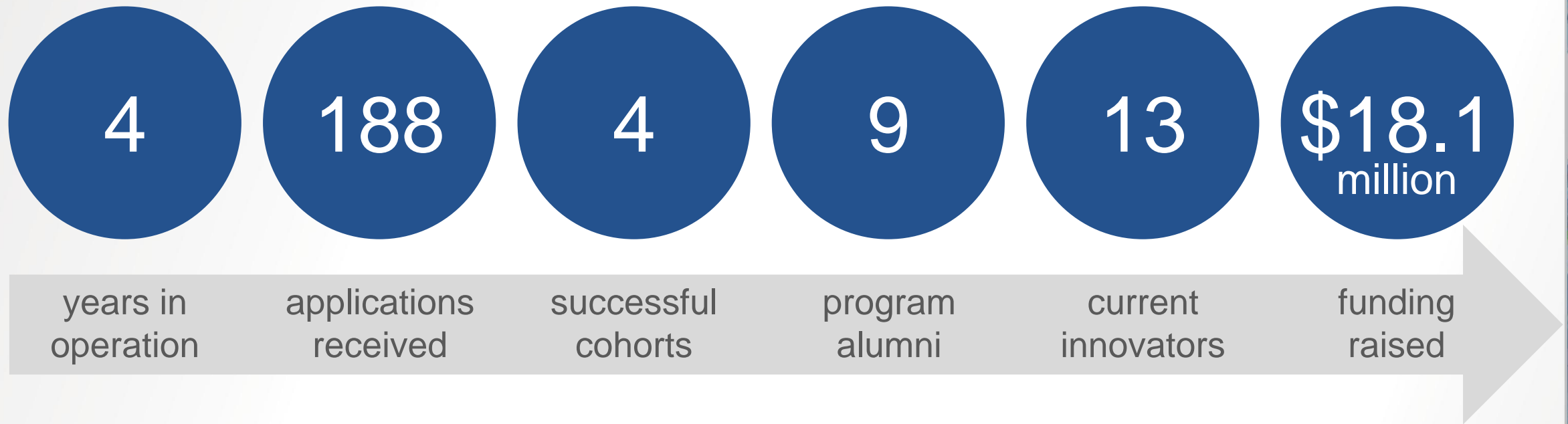


Oak Ridge National Laboratory is managed by UT-Battelle for the U.S. Department of Energy.

Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.



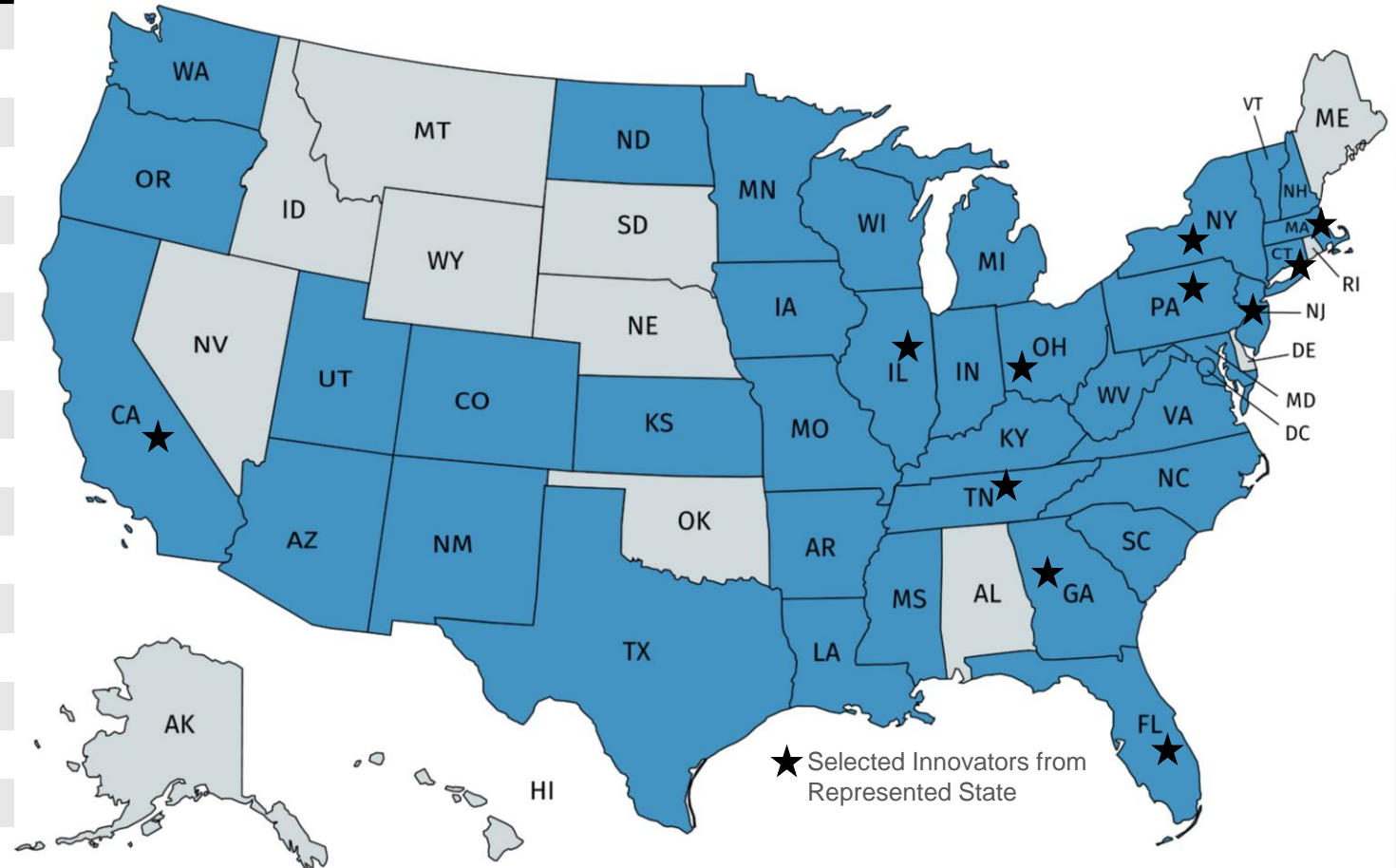
# Driving Impact by Embedding Entrepreneurs at ORNL



# Nationwide: Attracted 188 Candidates from 38 States

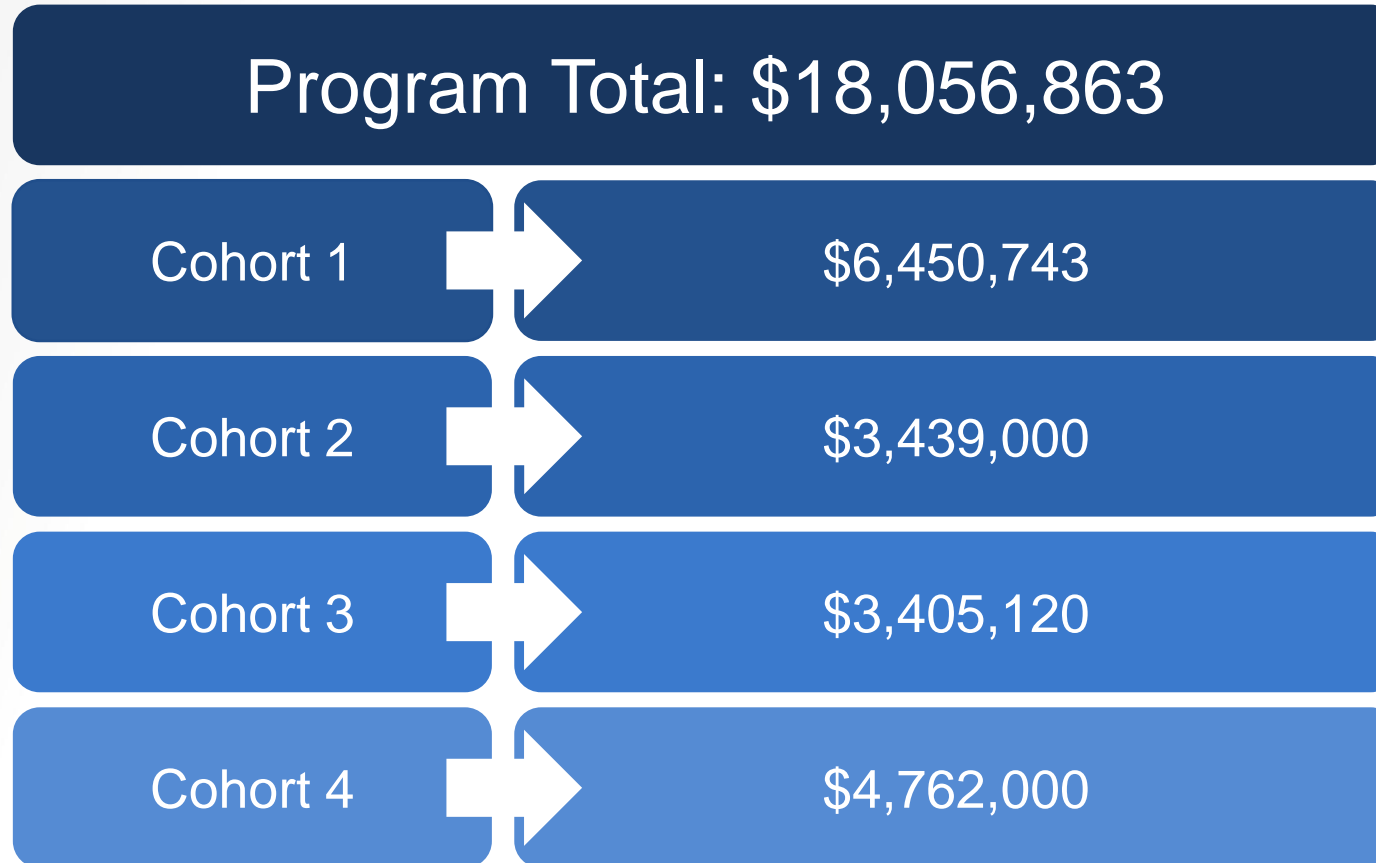
State	#	State	#
Arizona	3	Missouri	2
Arkansas	2	New Hampshire	1
California	16	New Jersey	3
Colorado	4	New Mexico	1
Connecticut	3	New York	14
District of Columbia	1	North Carolina	6
Florida	8	North Dakota	2
Georgia	7	Ohio	9
Illinois	6	Oregon	3
Indiana	1	Pennsylvania	4
Iowa	1	South Carolina	1
Kansas	1	Tennessee	34
Kentucky	4	Texas	5
Louisiana	6	Utah	2
Maryland	2	Vermont	1
Massachusetts	9	Virginia	6
Michigan	4	Washington	8
Minnesota	1	West Virginia	1
Mississippi	2	Wisconsin	2

Plus: Canada – 1, Mexico – 1





# Outside Funding Raised



# INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

## Application Process

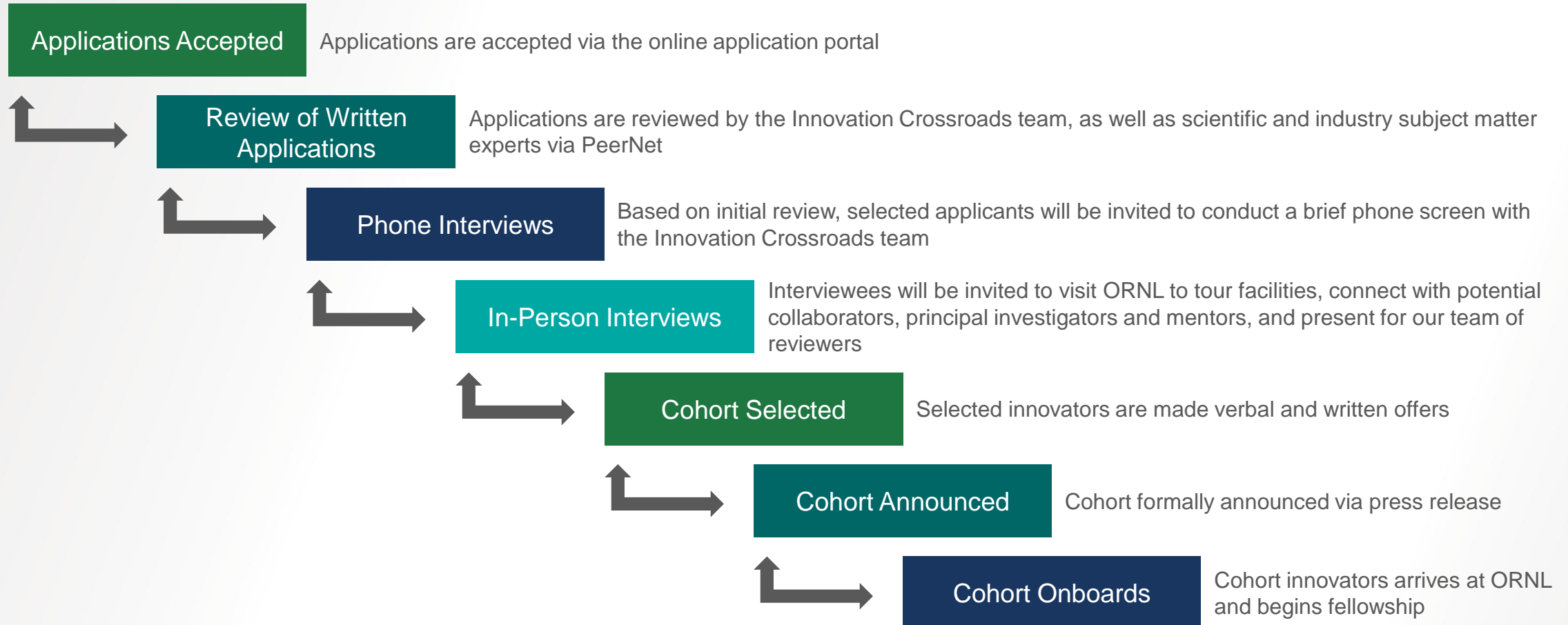


Oak Ridge National Laboratory is managed by UT-Battelle for the U.S. Department of Energy.

Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.



# The Process



# Cohort 5 Topic Areas

- **Advanced Manufacturing Track:**

- **Advanced Materials:** Discover and design next-generation materials and chemical processes for energy
- **Biotechnology:** Understand complexity in biological and environmental systems
- **Energy Systems:** Accelerate R&D and manufacturing of integrated energy systems
- **Isotopes:** Provide strategic capabilities in isotopes
- **National Security:** Deliver S&T to address pressing national security challenges
- **Neutron Science:** Advance the impact and application of neutron science
- **Nuclear Science:** Enhance scientific basis for breakthrough nuclear technologies and systems
- **Supercomputing:** Scale computing and data analytics to exascale and beyond

- **TVA Track:**

- **Advanced clean generation**, including advanced nuclear
- **Energy storage** and battery integration
- **Electric vehicles** and electrification
- **Smart cities** and connected communities
- **Grid integration and modernization**, including T&D controls, sensors, analytics, and distributed energy resources
- **Carbon removal**, including direct air capture
- **Hydrogen economy** (production, storage, transportation, and utilization)





# Potential Sponsor: Building Technologies Office

- Cost effective technologies and tools that support building energy efficiency
- Thermal energy storage systems for buildings
- Areas of particular interest and needed innovation include:
  - Advanced Building Retrofits such as both offsite and onsite envelope innovations
  - Advanced Building Construction with new construction innovations
  - Air sealing and diagnostics
  - High-R building insulation
  - Advanced thermal management technologies for envelopes and HVAC
  - Advanced methods (using usage data or other indicators) for detecting and alerting homeowners/facility managers of faults in major energy-using systems

# Eligibility Criteria

- Must apply as individuals, not as companies or organizations
- Must have PhD or equivalent experience
- Must leverage ORNL R&D capabilities and have an impact on the Department of Energy (DOE) and/or Tennessee Valley Authority (TVA) mission
- Must be willing to relocate to the Knoxville-Oak Ridge area for 2-years
- Must be a US citizen or lawful permanent resident at time of application
- Must successfully execute a Cooperative Research and Development Agreement (CRADA) with Oak Ridge National Laboratory
- Must disclose background IP rights, if necessary, that may be needed to freely operate on R&D related tasks as outlined within the CRADA



# Application Information

1. Complete online application form
2. Attach requested application materials as a single PDF document containing the following information:
  - **Resume (*one page*)**
    - Please provide a resume highlighting your education, experience, and skills.
  - **Tell us about yourself (*one page*)**
    - Provide the back story on you and your project. Where did the idea originate? What is the current status of your technology and team? Why do you want to pursue this effort and what makes you qualified to do so? Explain why you have chosen to pursue an entrepreneurial career path.
  - **Project abstract (*one page*)**
    - Briefly describe how you envision making your technology a market reality. Please describe the market you intend to reach, its customers, potential suppliers/distributors/manufacturers, relevant intellectual property (status of any licenses, etc.), barriers to entry, sophistication of market, market incumbents, etc.
  - **Tell us about your technology concept (*two pages*)**
    - Describe the technology concept you want to pursue. Use the Heilmeyer catechism as a guide for what's most relevant.
  - **What is the potential impact on the DOE, TVA, and/or ORNL mission? (*one paragraph*)**
    - Please comment on the potential for impact on U.S. energy and manufacturing competitiveness. More specifically on the potential for impact on the sponsor's mission area for your primary application track.
  - **Why ORNL and Innovation Crossroads? (*one page*)**
    - What most attracts you to Innovation Crossroads? Why would this be the ideal home for you and your project (vs. alternative paths)? Which people and/or facilities at ORNL would be particularly valuable in supporting your work?
  - **What else? (*one page*)**
    - An extra page for anything else that you feel we should know.

# Heilmeier Questions

- What are you trying to do?
  - Articulate your objectives using absolutely no jargon.
- How is it done today, and what are the limits of current practice?
- What is new in your approach and why do you think it will be successful?
- Who cares?
  - If you are successful, what difference will it make?
- What are the risks?
- How much will it cost?
- How long will it take?
- What are the mid-term and final “exams” to check for success?



# Evaluation Criteria

- How innovative is the proposed approach
- Potential market impact
- Applicant's technical understanding of the problem and proposed solution
- Evidence that ORNL capabilities can help advance the idea
- Soundness of the business concept
- Likelihood that the idea can be matured in the 2-year program



# INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

## Meet Our Innovators



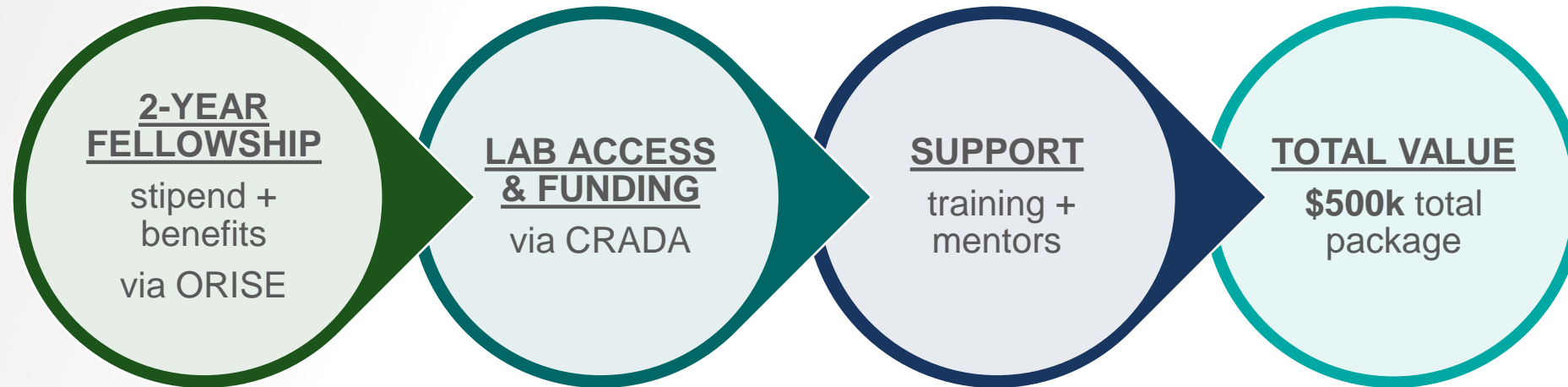
U.S. DEPARTMENT OF  
**ENERGY**

Oak Ridge National Laboratory is managed by UT-Battelle for the U.S. Department of Energy.

Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.



# World Class Support for Startups



## COHORT 1

- 2017-2019
- 4 Innovators (3 Companies)
- Sponsors: AMO, ORNL



## COHORT 2

- 2018-2020
- 5 Innovators
- Sponsors: AMO, ORNL



## COHORT 3

- 2019-2021
- 7 Innovators
- Sponsors: AMO, ORNL, TVA



## COHORT 4

- 2020-2022
- 6 Innovators (5 companies)
- Sponsors: AMO, ORNL, TVA



# Innovation Crossroads Innovators – Alumni



**Anna Douglas**  
SkyNano Technologies  
*Vanderbilt University*



**Michell Ishmael**  
Active Energy Systems  
*Cornell University*



**Matthew Ellis & Samuel Shaner**  
Yellowstone Energy  
*Massachusetts Institute of Technology*



**Fellowship Began: May 2017**  
**Fellowship Completion: May 2019**



# Innovation Crossroads Innovators – Cohort 2



**Don DeRosa**

Eonix

*State University of New York at Albany*



**Shane McMahon**

Lux Semiconductors

*State University of New York at Albany*



**Justin Nussbaum**

Ascend Manufacturing

*University of South Florida*



**Megan O'Connor**

Nth Cycle

*Duke University*



**Matt Smith**

TCPoly

*Georgia Institute of Technology*



**Fellowship Began: May 2018**  
**Fellowship Completion: August 2020**

# Innovation Crossroads Innovators – Cohort 3



**Jesse Claypoole**  
MantaPoole Technologies  
*State University of New York at Albany*



**William Fitzhugh**  
American Nanotechnologies  
*Harvard University*



**Hicham Ghossein**  
Endeavor Composites  
*University of Tennessee*



**Alex Lewis**  
Electro-Active Technologies  
*University of Tennessee*



**Trevor McQueen**  
Neptune Fluid Flow Systems  
*Stanford University*



**Leila Safavi**  
Purist  
*University of California Irvine*



**Jesse Thornburg**  
Grid Fruit  
*Carnegie Mellon University*



**Fellowship Began: June 2019**  
**Fellowship Completion: June 2021**



# Innovation Crossroads Innovators – Cohort 4



**Renee Carder**  
PixelEXX Systems  
*University of California*



**Danielle Castley**  
Becq  
*Dartmouth College*



**Joe Fortenbaugh**  
Actinic  
*Pennsylvania State University*



**Thomas Foulkes**  
AquaQuant Laboratories  
*University of Illinois*



**Erica Grant**  
Quantum Lock Technologies  
*University of Tennessee*



**Garrett Meyer**  
AquaQuant Laboratories  
*Rose-Hulman Institute of Technology*

# INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

## Programming and Ecosystem



Oak Ridge National Laboratory is managed by UT-Battelle for the U.S. Department of Energy.

Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.





# Recurring Meetings

- Bi-weekly group meeting with all innovators
- Monthly 1-on-1 meetings with each company
- Annual renewal briefing with each innovator



# Regional Entrepreneurial Ecosystem



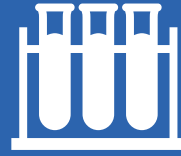
## TALENT

- Innovation Crossroads
- University of Tennessee



## SUPPORT

- Energy Mentor Network
- Innov865 Alliance
- Knoxville Entrepreneur Center
- Launch Tennessee
- PYA
- Startup Knox
- TAEBC
- University of Tennessee



## R&D ASSETS

- Oak Ridge National Laboratory
- Tennessee Valley Authority
- University of Tennessee



## CAPITAL

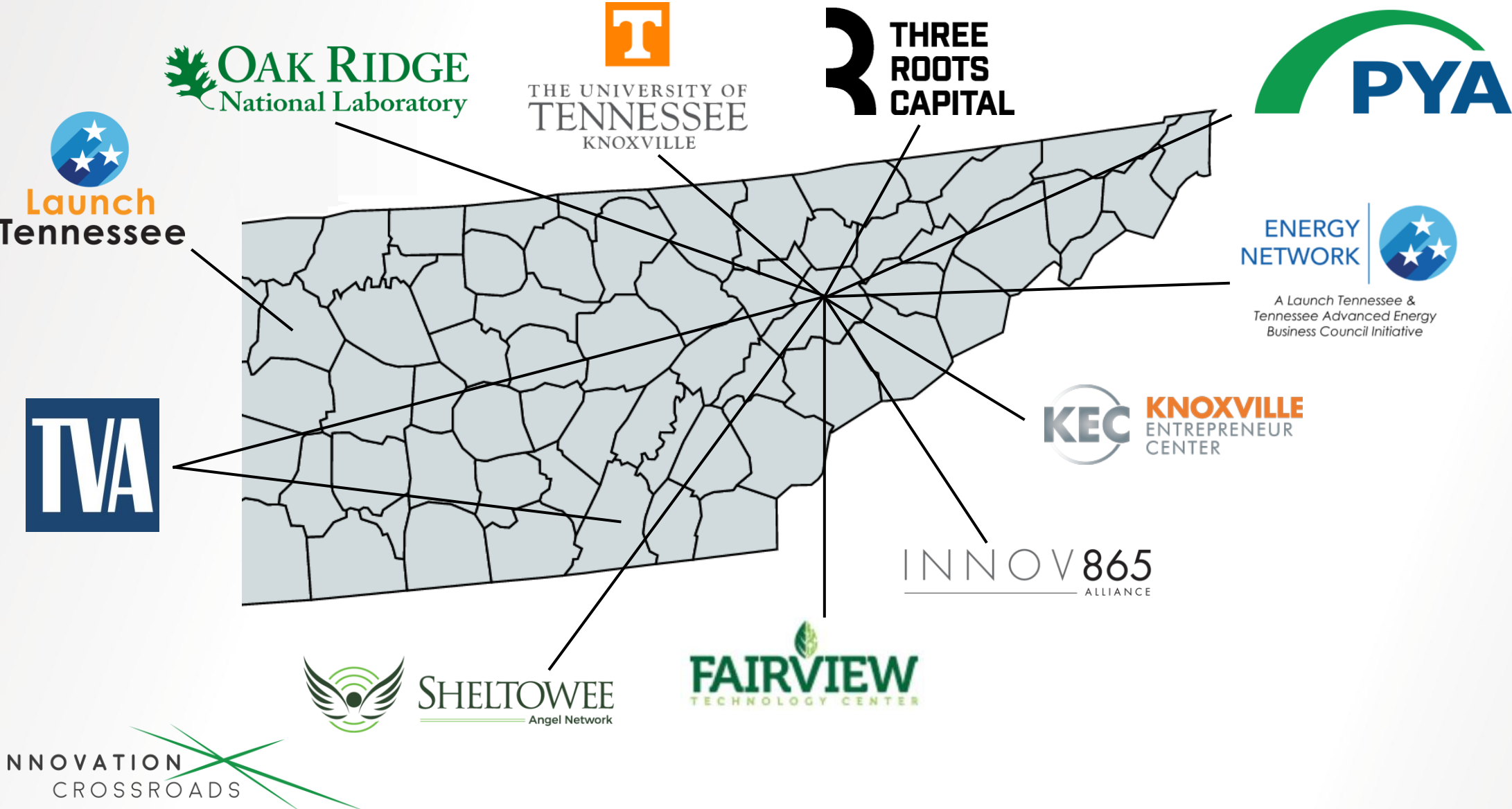
- Angel Capital Group
- Cocoon Resources
- Three Roots Capital



## SPACE

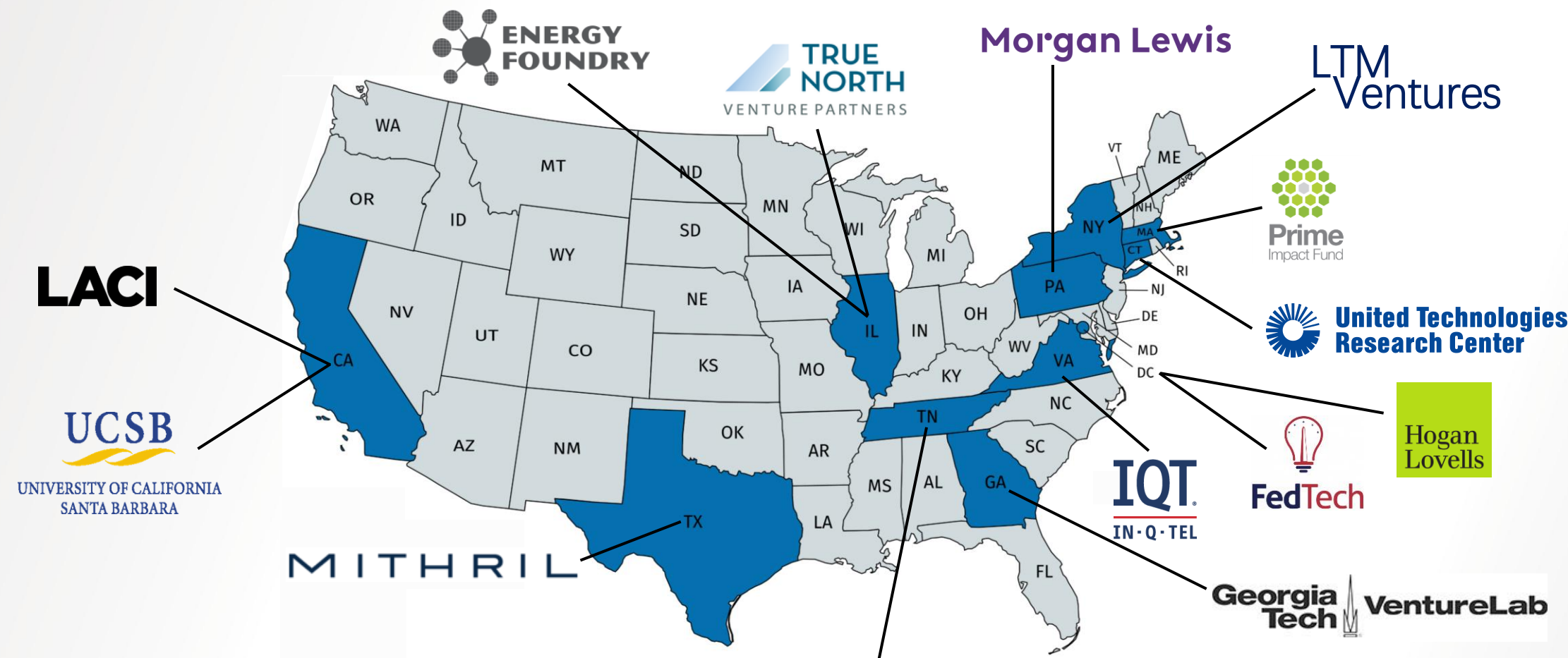
- Anderson Center for Entrepreneurship and Innovation
- Fairview Technology Center
- Spark Innovation Center
- Ts117 Coworking Space

# Development of a Regional Entrepreneurial Ecosystem





# Development of a Robust Advisory Network





# Featured Ecosystem Partners

## ENERGY NETWORK



The Energy Mentor Network is run by the Tennessee Advanced Energy Business Council in partnership with Launch Tennessee. The Energy Mentor Network program is a free statewide mentoring program for early-stage companies in the life science and advanced energy industries. The objective of the program is to pair entrepreneurs with mentors and industry specific expertise to develop a compelling commercialization strategy and prepare for funding and growth.



FedTech provides entrepreneurship support by offering business development workshops focuses on proposal capture, team development, and company operations. In addition, innovators have direct access to the FedTech team of seasoned entrepreneurs and early-stage startup investors, allowing for customized advising opportunities, where mentors counsel on government funding strategies, business development, industry relationship building, and much more.



The Innov865 Alliance develops, supports, and promotes the Knoxville region's entrepreneurial ecosystem. It is a collaborative effort to celebrate and showcase Knoxville as a great place for entrepreneurs to start and grow businesses and increase access to capital. In addition to their signature event, Innov865 Week, the Innov865 Alliance coordinates other activities throughout the year, including pitch competitions, educational opportunities, and social events.



# Featured Ecosystem Partners



The Knoxville Entrepreneur Center is a local mentor-driven business accelerator that serves as the front door for entrepreneurs in the Knoxville region and a resource for anyone looking to start or grow a business in Knoxville. By nurturing and supporting a culture of entrepreneurship, they foster innovation, creativity, and job growth within the community. Join the KEC entrepreneurial community to gain access to the capital, customers, and talent needed to be successful.



Launch Tennessee is a public-private partnership that supports entrepreneurs from ideation to exit. They are guided by a vision to make Tennessee the most startup-friendly state in the nation. Tennessee is one of few states with an entrepreneur-resource infrastructure operating at the state level. Through Launch Tennessee's statewide network, they deliver curriculum, mentors, funding opportunities, and more to entrepreneurs building high-growth-potential businesses.



Morgan Lewis is committed to serving the public good. As such, their innovative and award-winning partners provide pro-bono council to Innovation Crossroads innovators via structured quarterly webinar sessions and one-on-one customized council. Webinar topics include: U.S. patent system, international patent applications, IP management and protection for lean start-ups, inventorship and enterprise considerations, preparing for due diligence, angel and venture funding, etc.



# Featured Ecosystem Partners



PYA is a national professional services firm providing deep functional expertise in tax, audit and assurance, healthcare, technology, business advisory, and management consulting. PYA's team contributes partner-level support to innovators, by offering financial and business strategy insights and guidance. Their team of professionals meets with innovators as a group and individually to provide general accounting support, QuickBooks demonstration, and personal set-up assistance.



TAEBC champions advanced energy as a job creation and economic development strategy. They educate public officials and business leaders about Tennessee's advanced energy assets, establish strategic partnerships to connect assets with opportunities, and inform policy that expands and strengthens the industry. In addition, TAEBBC develops programs that connects and leverages the state's assets with opportunities to promote Tennessee's advanced energy economy.



In partnership with the University of Tennessee in Knoxville, program innovators have direct access to work with Bredesen Center graduate student interns for market research and customer discovery assistance, receive pro bono legal guidance and assistance from the UT College of Law Legal Clinic, and tap into a network of coaches, mentors, and business development resources and programs made available by the Anderson Center for Entrepreneurship and Innovation.



# INNOVATION CROSSROADS

OAK RIDGE NATIONAL LABORATORY

## Discussion



U.S. DEPARTMENT OF  
**ENERGY**

Oak Ridge National Laboratory is managed by UT-Battelle for the U.S. Department of Energy.

Innovation Crossroads is a public-private partnership founded by Oak Ridge National Laboratory and supported by the DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office and the Tennessee Valley Authority.





# APPLY FOR COHORT 5 THIS FALL

APPLICATIONS OPEN SEPTEMBER 15, 2020

INNOVATIONCROSSROADS.ORNL.GOV

## PROGRAM

Innovation Crossroads is an early stage entrepreneurial fellowship program at Oak Ridge National Laboratory that matches aspiring entrepreneurs with experts, mentors and networks in technology related fields to take their world-changing idea from R&D to marketplace.

## ELIGIBILITY REQUIREMENTS

- Apply as individuals, not as companies or organizations
- Have PhD or equivalent experience
- Leverage ORNL R&D capabilities and have an impact on the DOE and/or TVA mission
- Be willing to relocate to the Knoxville-Oak Ridge area for 2-years
- Be a US citizen or lawful permanent resident at time of application
- Successfully execute a CRADA with ORNL
- Disclose background IP rights, if necessary, that may be needed to freely operate on R&D related tasks as outlined within the CRADA

## IMPORTANT DATES

- September 15, 2020 – Applications Open
- October 31, 2020 – Applications Close
- June 2021 – Cohort 5 Begins

## WHAT YOU GET

- **A two-year fellowship**  
*The two-year fellowship includes a personal living stipend, plus a health insurance stipend and travel allowance.*
- **Lab access and research funding**  
*In addition to unparalleled access to facilities, equipment, and expertise at Oak Ridge National Laboratory, fellows receive R&D funding to support collaboration opportunities with researchers across the lab.*
- **Business mentors, entrepreneurial training, and networking**  
*Participants receive access to experienced business mentors, entrepreneurial training programs, and exclusive networking opportunities. Innovators are also exposed to a wide range of leaders from academia, industry, government and finance that can serve as advisors and partners.*



## INFORMATIONAL WEBINARS

- Wednesday, September 23rd, 2:00 p.m. (ET)
- Tuesday, October 6th, 1:00 p.m. (ET)
- Thursday, October 22nd, 3:00 p.m. (ET)