



CARB-X

Xccelerating global antibacterial innovation

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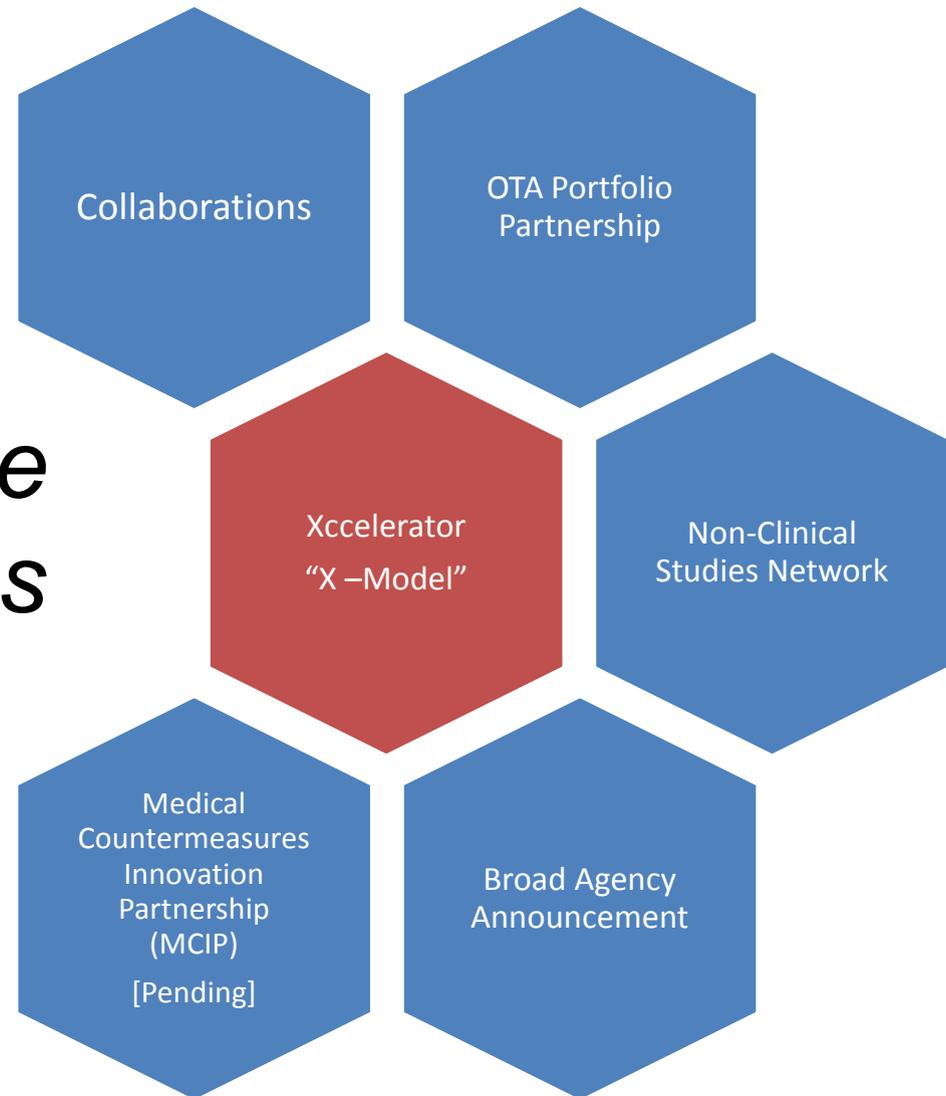


At BARDA We Seek Innovation in...

Science and in the way we do business

CARB-X

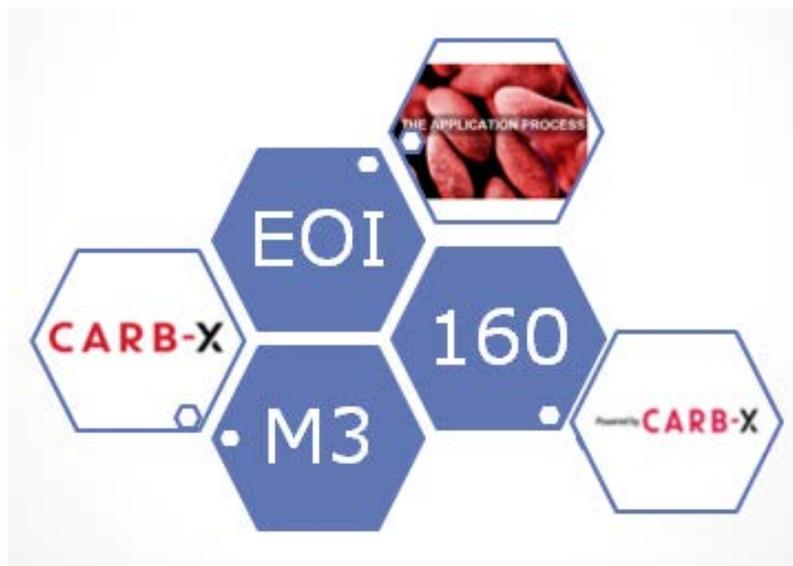
Xccelerating global antibacterial innovation





CARB-X: A Year of Progress

BARDA Industry Day 2016
“Dreaming of a Portfolio”

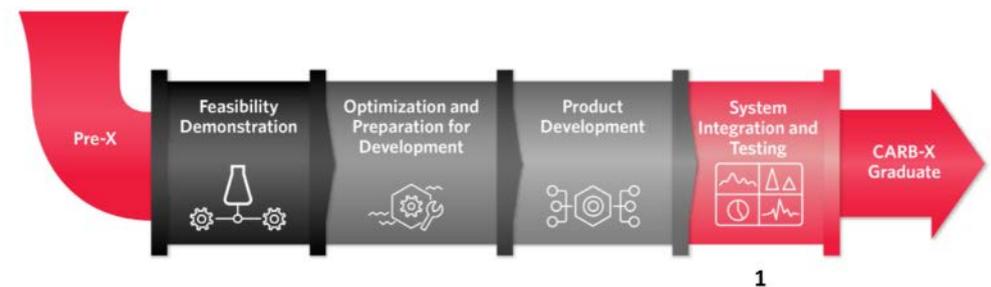


BARDA Industry Day 2017
“CARB-X is Powering Innovation”

Therapeutics and Preventatives



Diagnostics and Devices





CARB-X Portfolio Powered by CARB-X

The CARB-X portfolio comprises 18 early stage R&D projects investigating 8 new classes of antibiotics, 5 non-traditional antibiotics, 10 new molecular targets and a rapid diagnostic to determine the type of drug-resistant bacteria that is causing an infection.

Company/Research Team	Project	Novelty*			Project description	Urgency/Priority**	Bacteria Targeted / Stage of Early Development				
		New Class	Non-traditional	New Target			Hit to Lead	Lead Optimization	Pre-Clinical	Phase 1	
Achaogen	AKAO-LpxC	✓		✓	LpxC Inhibitor	✓	Pseudomonas aeruginosa				
Antabio	PEI		✓	✓	Pseudomonas Elastase inhibitor	✓	Pseudomonas aeruginosa				
Bugworks Research	Gyrox	✓			Gyrase-topoisomerase inhibitor	✓	Gram-negative activity				
Cidara Therapeutics	CD201		✓	✓	Bifunctional immunotherapy	✓	Acinetobacter + P. aeruginosa + Enterobacteriaceae				
ContraFect	Gram-negative lysins		✓	✓	Recombinant lysin protein	✓	P. aeruginosa				
Debiopharm	Debio 1453	✓		✓	Narrow-spectrum inhibitors of FabI	✓	Neisseria Gonorrhoeae				
Eligochem	Helical AMP	✓			Helical Antimicrobial Peptide	✓	Gram-negative activity				
Entasis Therapeutics	ETX000				Oral Gram-negative combination	✓	Gram-negative activity				
Forge Therapeutics	FG-LpxC	✓		✓	LpxC Inhibitor	✓	Gram-negative activity				
Iterum	Sulopenem				Oral and IV penem	✓	Gram-negative activity				
Microbiotix	T3SS Inhibitor		✓	✓	Virulence modifier	✓	Pseudomonas aeruginosa				
Oppilotech	LPS	✓		✓	Targets synthesis of LPS	✓	Gram-negative activity				
Redx Pharma	NBTI	✓			Dual-acting topoisomerase inhibitor	✓	Acin. + P. aerug + Enterobacteriaceae				
Spero Therapeutics	SPR741			✓	Potentiator	✓	Gram-negative activity				
Tetraphase Pharm	TP-6076				Next-generation tetracycline	✓	Acinetobacter + Enterobacteriaceae				
VenatoRx	VNRX-PBP	✓			β-lactamase Resistant PBP Inhibitor	✓	Entero-bacteriaceae				
Visterra	VIS705		✓	✓	Antibody-drug conjugate	✓	Pseudomonas aeruginosa				

Company/Research Team	Project	Project description	Development Stage			
			Feasibility Demonstration	Optimization and Preparation for Development	Product Development	System Integration and Testing
Proteus	Rapid POC Diagnostic	Optical bacterial imaging	POC Diagnostic			

Powered by **CARB-X**
 9 new classes of antibiotics
 9 Non Traditional Approaches
 11 New Targets
 \$57.5M Base/ \$72.15M Options

Coming Soon:

>10 projects now in late stage review
 Cycle 3 Announcement



For more info visit www.CARB-X.org

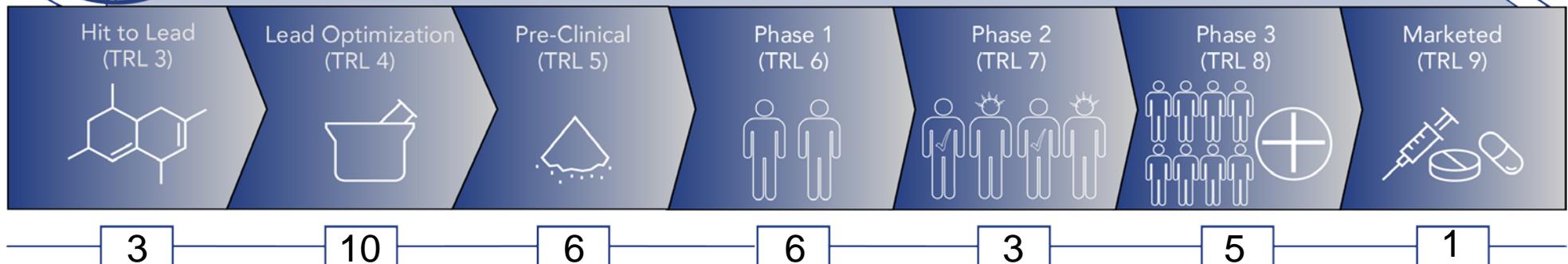
* Novelty characterizations of new class and new target are established by CARB-X following the Pew Trusts pipeline analysis model. Pew defines a novel chemical class as a group of antibiotics that share a new common core molecular structure. Non-traditional products include lysins and monoclonal antibodies.
 ** Urgent and priority drug-resistant bacteria are determined by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO).
 ✓ Urgent/Critical priority ⚪ Serious/High priority ⚪ Serious/Medium priority.
 Stage of development is approximate as of July 2017.



CARB-X is just one part of our expanding Antibacterial Portfolio



Investing \$192 million in FY 2017 through Novel Public Private Partnerships to support a Portfolio of Antibacterial Products to repopulate the Antibacterial Pipeline and enhance MCM effectiveness



Total number of products supported

34

CARB-X

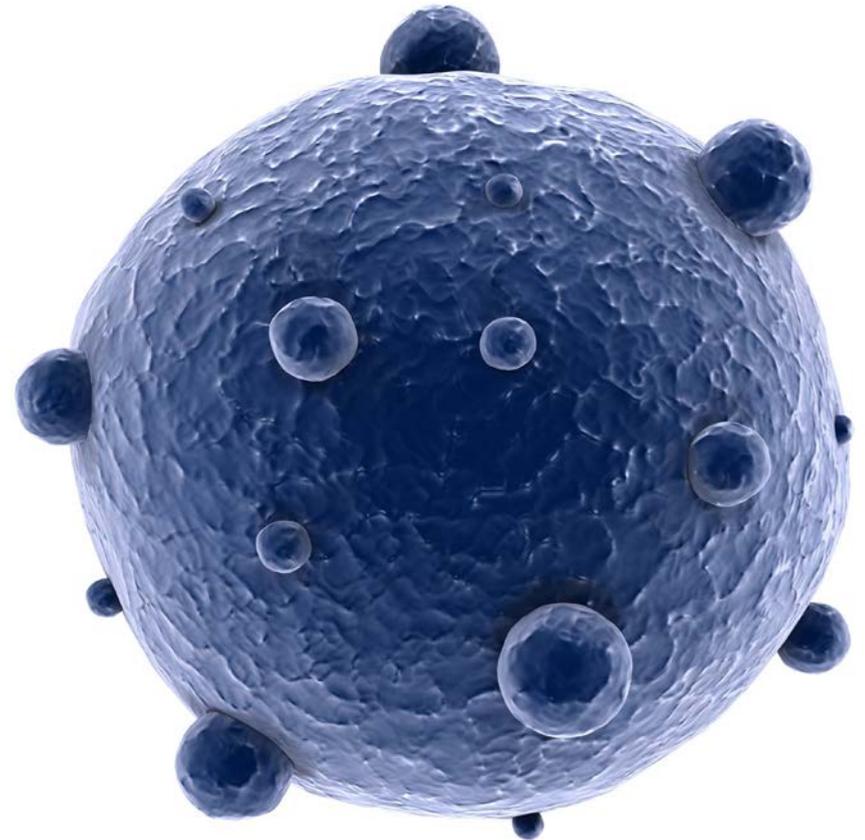


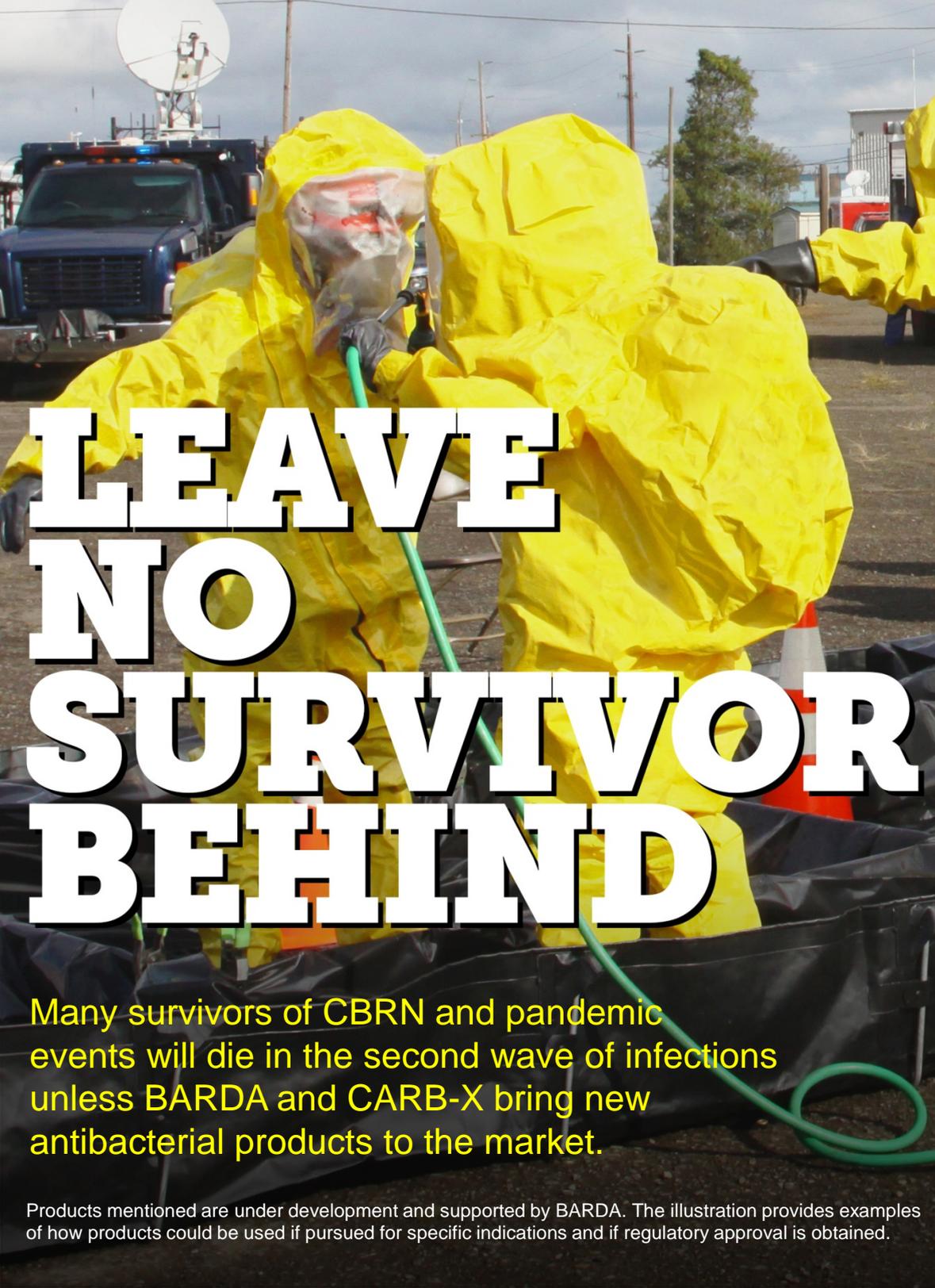
Updated November 6, 2017



Why is BARDA supporting Antibacterial Product Development?

- Because the rate of drug development has not kept pace with the growth of antibacterial resistance
- 2M infections per year caused by Antimicrobial Resistant (AMR) pathogens
- 23,000 deaths annually in US
- Estimated economic burden of \$20-35B annually
- Must meet the requirements in the National Strategy and National Action Plan for Combating Antibiotic-Resistant Bacteria (CARB)
- **To enhance biodefense preparedness: Antibacterial resistant infections will complicate the USG response to a CBRN attack, an influenza pandemic, emerging infectious disease outbreak or any other public health emergency**





LEAVE NO SURVIVOR BEHIND

Many survivors of CBRN and pandemic events will die in the second wave of infections unless BARDA and CARB-X bring new antibacterial products to the market.

Products mentioned are under development and supported by BARDA. The illustration provides examples of how products could be used if pursued for specific indications and if regulatory approval is obtained.



CHEMICAL

- Medical Risk: Primary lung injury leads to secondary infections from Staphylococcus aureus, Acinetobacter baumannii, and Pseudomonas aeruginosa resulting in bronchopneumonia.
- BARDA's Response: Vabomere, Ceftobiprole, Aztreonam Avibactam, Eravacycline, MRSA vaccine



BIOLOGICAL

- Medical Risk: Current bioterror agents genetically engineered to overcome available medical countermeasures in the Strategic National Stockpile
- BARDA's Response: All BARDA sponsored antibiotic development programs support development and evaluation of products against at least one or multiple bioterror agents



RAD/NUC

- Primary neutropenia and immune ablation that can lead to secondary infections from gram positive and gram negative bacteria resulting in sepsis
- BARDA's Response: MRSA vaccine, Ceftobiprole, Eravacycline, Aztreonam Avibactam
- Medical Risk: Complex interventions and surgeries for burn and blast traumatic injuries increases their vulnerability to hospital acquired infections resulting in pulmonary sepsis, wound sepsis and pneumonia
- BARDA's Response: MRSA vaccine, Ceftobiprole, Vabomere, Eravacycline, Aztreonam Avibactam



PANDEMIC

- Medical Risk: Lethal secondary infections from drug resistant pneumococcus and MRSA
- BARDA's Response: Ceftobiprole, Solithromycin, MRSA vaccine



CARB-X Overview

CARB-X accelerates R&D to combat the rising threat of serious drug-resistant bacterial infections



Urgent public health need

Antibiotic resistance kills an estimated 700,000 people each year world-wide. No new classes for drug-resistant Gram-negative bacteria have been approved in decades



New global partnership model

CARB-X represents a new novel public-private partnership model to accelerate the development of life-saving antibiotics, vaccines, devices and rapid diagnostics



Turning science into products

Non-dilutive funding and Accelerators with drug development and business support services to help companies with promising products to become life-saving antibiotics, vaccines and rapid diagnostics to treat serious drug-resistant bacterial infections



CARB-X's first year results

Program operational 2 years ahead of schedule: 18 companies in 6 countries; 8 are pursuing new classes against Gram-negative bacteria; 10 new molecular targets; 5 non-traditional products; one rapid POC diagnostic





BARDA is Accelerating Public Private Partnerships to Higher Levels

\$455M FUNDING

Wellcome Trust, BARDA and NIAID provide funding and pre-clinical services



BEST SCIENCE

SAB reviews applications and recommends to JOC projects for funding

GOVERNANCE

JOC provides oversight, develops strategy and makes investment decisions

BOSTON UNIVERSITY ADMINISTRATION

Hosted by a leading research university, with world-class research administrative support

EXPERT SUPPORT

Partners provide scientific and business expertise to accelerate the research projects



368 applications

from scientists around the world reviewed in 2016-17. SAB reviews applications and recommends to JOC projects for funding.

CARB-X

CARB-X ensures the integrity of the application and review process and works closely with partners, funded companies and global networks to support and accelerate antibacterial innovation.

18 projects

in 6 countries awarded \$41.6M in 2016-17 with an additional \$52.6M more in milestone based options.





Government Can Drive Innovation!

CARB-X

powered by



- The “X” model is another example of how BARDA is innovating both *in Science and in the way we do Business*
- Innovation in antibacterial product development is needed. CARB-X is operational and Xcelerating antibacterial products to the clinic
- CARB-X is just one part of BARDA’s Portfolio
- CARB-X is growing to address domestic national security preparedness and global health security
- **Coming Soon:**
 - New Accelerators,
 - New Powered by CARB-X Awards
 - New Funders
 - New Funding Announcements





In 2018 will your company be...?

Powered by **CARB-X**