

# Better Buildings Alliance Technology Solutions Team: Building Envelope

2017 Building Technologies Office Peer Review



# Project Summary: Building Envelope Technology Solutions Team

## Timeline:

Start date: October 1, 2014

Planned end date: September 30, 2019

## Key Milestones

1. Kickoff Building Envelope Technology Solutions Team; Nov. 30, 2016
2. Conduct 1 to 2 Technology Team Meetings; Sept. 30, 2017
3. Prepare 1 to 2 Technical Resources; Sept. 30, 2017

## Budget:

### **Total Project \$ to Date:**

- DOE: \$645,000
- Cost Share: \$0

### **Total Project \$:**

- DOE: \$1,085,000
- Cost Share: \$0

## Key Partners:

Buildings Technology Office (BTO)/ Commercial Building Integration (CBI) Program
Better Buildings Alliance (BBA) Partners
Better Buildings Challenge (BBC) Partners
BBA Technology Solutions Teams
Architecture & Engineering (A&E) firms
Trade Associations: ABAA, EIMA, and SPRI
Rating Organizations: AERC, NFRC

## Project Outcome:

- Establish BBA Building Envelope Technology Solutions Team supporting faster adoption of market ready high efficiency building envelope technologies, including: R-5 windows, dynamic windows, and envelope air sealing strategies
- Recruit BBA Partners, BBC Partners, and A&E firms to the Technology Team and support demonstration projects and technical resources that advance envelope energy saving strategies

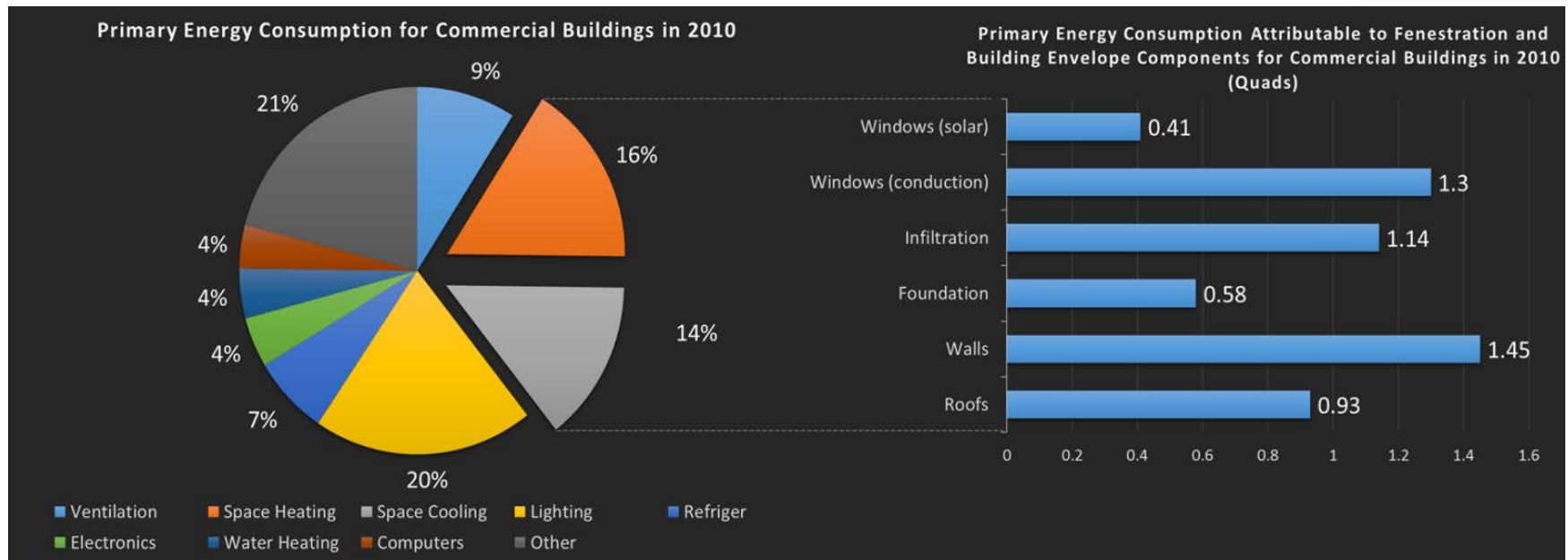
# Purpose and Objectives: Addressing High Impact Envelope Technologies

**Problem Statement:** While advanced high-performance building envelope technologies – including roofs, walls, and windows – present an **opportunity to address the primary determinant of energy use** in commercial buildings, significant market barriers and challenges\* exist, including:

- ✓ **Cost:** uncertainties, high first costs, ROI hurdles
- ✓ **Supply issues:** product fragility, availability, volume
- ✓ **Installation issues:** workforce training, complex systems, quality control
- ✓ **Decision culture:** resistance to new products, risk-averse, code minimum culture
- ✓ **Information gap:** lack of real-world case studies, data on long-term performance, effective communication

**Target Audience:** Building owners/managers and the design community, including A&E firms

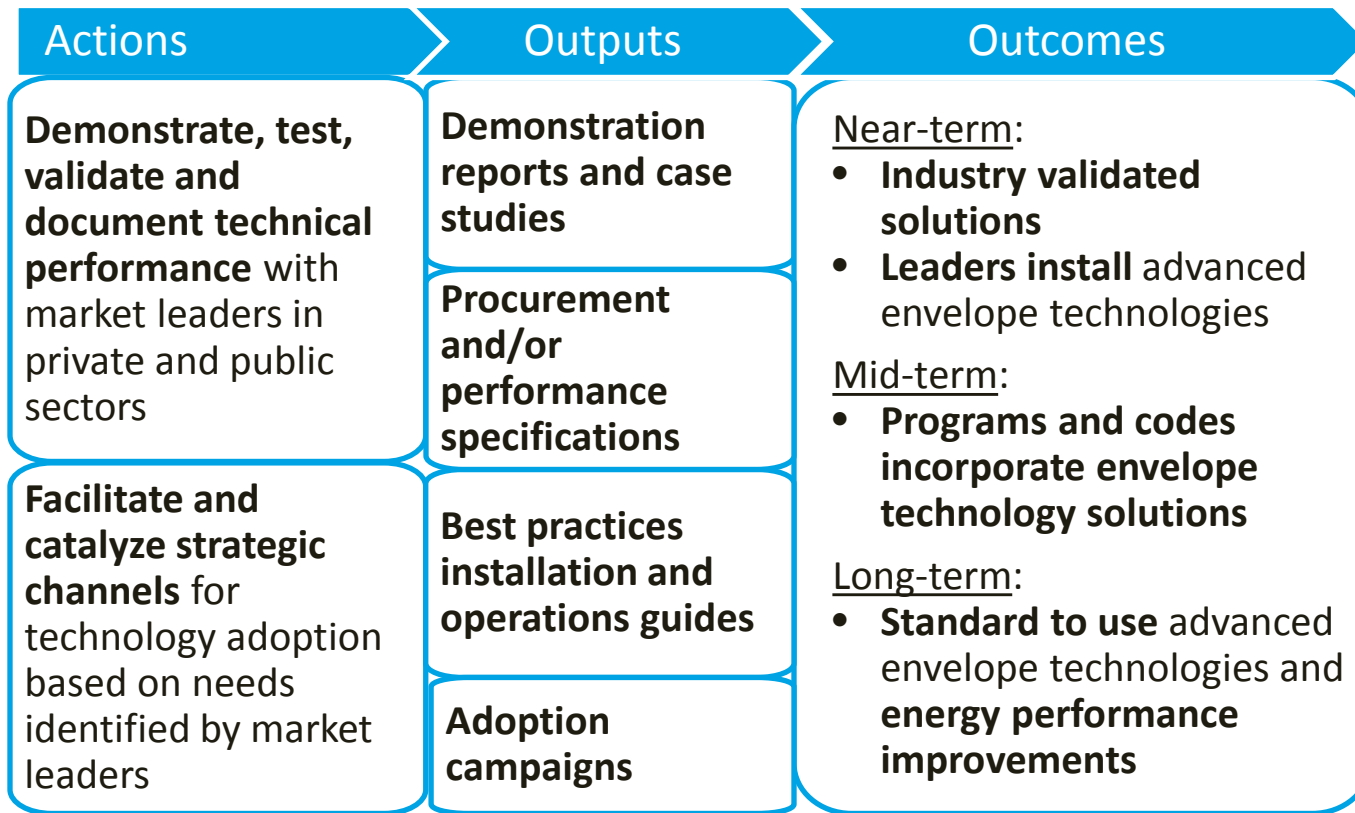
Opportunity:  
Catalyze market with Building Envelope Technology Solutions Team targeting BBA Partner market leaders



# Purpose and Objectives: Catalyzing the Market for Envelope Technologies

## Project Impact: **Demonstration of high performance envelope technologies and solutions via a Technology Solutions Team**

comprised of Better Buildings Partners and representatives from the design community, including A&E firms



**New Project:**  
Building Envelope Technology Solutions Team

### Potential Impact of Prioritized Envelope Technologies

**R-5 windows:**  
~175 Tbtu

**Dynamic windows:**  
~300 Tbtu

**Envelope air sealing strategies:**  
~200Tbtu



# Approach: Facilitating Market Adoption

## Engage an Active Technology Solutions Team

- **Recruit Technology Team members** among BBA partners and representatives from the design community to **collaborate with ORNL and DOE** on advancing investment in envelope technologies
- Conduct **at least 2 Technology Team meetings** to engage members in adoption of envelope technologies
- **Work with Tech Team members**, industry experts, and interested stakeholders among the design community to develop tech resources that accelerate deployment of envelope energy saving strategies

## Build Awareness

- **Prime the market** by strengthening building owners/manager's understanding of envelope technologies
  - Conduct **envelope technology demonstrations**
  - Provide **guidance and information** on envelope technology solutions
  - Offer **technical assistance** for envelope projects

## Document and Validate Results

- Prepare **site M&V plans** for technology demonstrations
- **Record demo results and produce reports**, such as case studies and/or guidance for use in training, codes and/or standards

## Develop and Promote Technical Resources

- Develop **Building Envelope Technology Team webpages** for primary subcategories for envelope technologies: **Windows, Walls, Roofs**
- Create specifications, guidance, case studies, fact sheets, etc. that **address market barriers and assist advancement** of envelope technologies
- **Promote use of technology toolkits** and solutions among Tech Team members

# Approach: Understanding Key Characteristics

## Listening to Stakeholders:

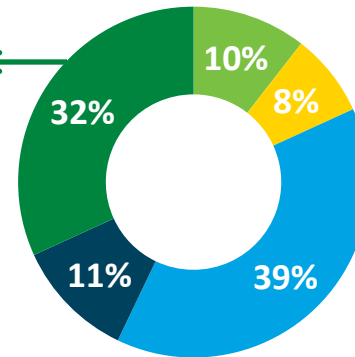
- Held industry workshop at ORNL with over **100 attendees** (May 2015)
- Conducted five-part webinar series, engaging over **690 participants** (Spring 2016)

Webinar Topic	Number of Participants
Air Barriers	108
Walls	141
Roofs	159
Windows/ Attachments	146
Whole Building Systems	138

## Meeting Participant Types

### Other Represented by:

- Code officials
- State Govts
- Auditors
- Consultants
- Trade Associations
- Utilities
- Non-profits



- manufacturer
- building owners/managers
- architect/engineer
- researcher
- other

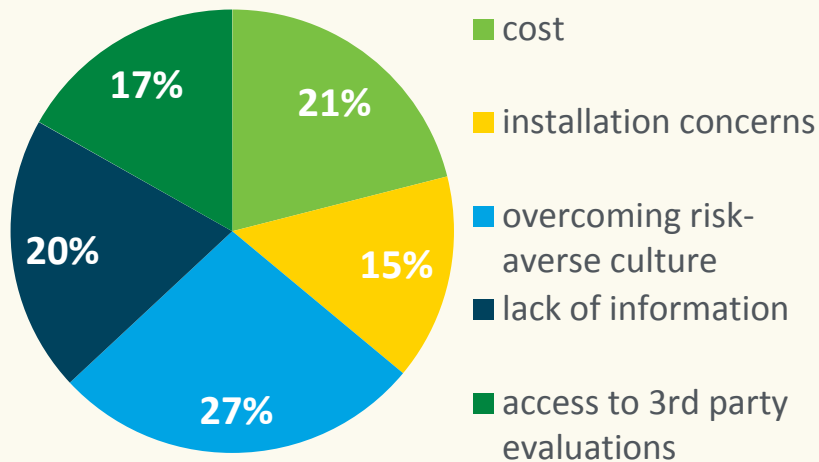
N=406. Responses from 2016 Webinar Series and Nov. Kickoff Mtg.

- The **design community**, represented by the **A&E category** at the highest count, is **central** to advancing envelope technologies
- **Building owners/managers** may have represented the minority on webinars, but consistently they **participated actively** in the webinar polls and Q&A commentary

# Approach: Addressing Key Issues

## Envelope Market Barriers are Complex

Which barrier is of most concern when investing in envelope technologies?



N=180. Responses from 2016 Webinar Series

- Overcoming a **risk-averse culture** ranks **highest** with the other barriers ranking closely behind
- **Cost** ranks as highest concern for **building owners/managers**
- **Installation concerns** were *not raised* by building owners/managers, **but they were for A&E firms**
- **Overcoming a risk-averse decision making culture** ranks as highest for **A&E firms**

Envelope  
Technology  
Team Action

What resources, aside from financing, would help advance investment in commercial building envelope technologies?

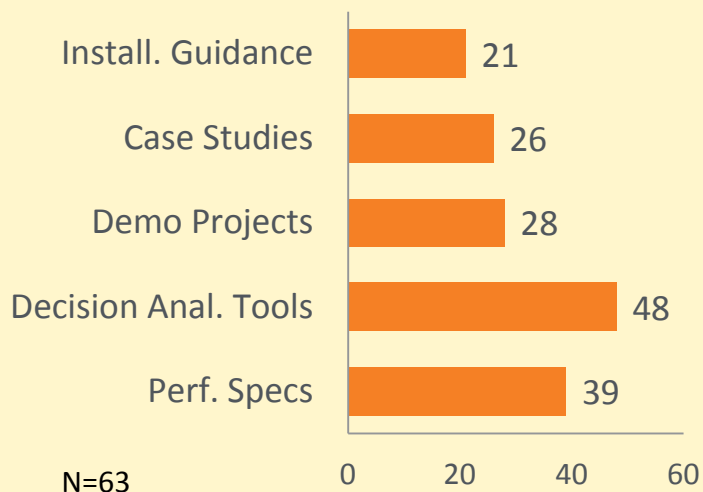
- ✓ **Case studies** with ROI, payback, and performance documented
- ✓ Decision **analysis tools**, calculators
- ✓ **Less disruptive technologies**

## Approach:

# Understanding the Challenges and Needs

**Gathered feedback** from stakeholders\* on the best methods for addressing barriers to adoption

**Which resources would help advance investments in energy-saving envelope projects?**



**Drilling in on responses by building owner/manager participants:**

Resource Type	Owner/Manger Participant Response
Installation Guidance	14%
Case Studies	12%
Demo Projects	17%
Decision Analysis Tools	13%
Performance Specifications	18%

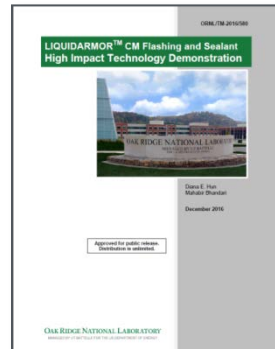
**FY '17 Focus:** ✓ Demo projects to validate windows and air barrier technologies  
✓ Air barriers market analysis to identify specifications guidance



# Progress and Accomplishments: Developing Market Actor Involvement, Awareness



# Progress and Accomplishments: Making an Impact



## Increasing Awareness and Involvement:

- Consistently, meetings and workshops are garnering **large participation**, particularly among the **design community**, including **A&E firms**, and **BBA Partners**

## Growing Envelope Tech Team Membership:

- Since launching in November, **recruited 10 Tech Team members and 9 supporting organizations**

## Webpage Traffic:

- To date, site has **over 200 page views**, surpassing page view counts for the other BBA Technology Solutions Teams

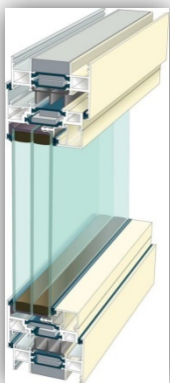
## Validating Advanced Envelope Technology:

- ORNL **verified the performance** of LIQUIDARMOR® CM Flashing and Sealant with field tests and energy simulations of the Homeland Security Training Center at the College of DuPage in Glen Ellyn, IL
  - 9% reduction of heating and cooling costs** with air barrier installation
  - 3 to 4 times faster installation** than tape

### Envelope Technology Solutions Team

Member Organization	Type
Clark Atlanta University	Building Owner/Manager
Hersha Hospitality Management	Building Owner/Manager
Legacy Health	Building Owner/Manager
US Army Corps of Engineers	Building Owner/Manager
Newmark Grubb Knight Frank	CRE management
Exp.com	Architect/Engineer
Association for Energy Affordability	Architect/Engineer
Instituto Superior de Engenharia do Porto	Architect/Engineer
Z2zero	Architect/Engineer
D. Schmidt Consulting	Architect/Engineer
Supporters	
Apple Blossom Energy, Argonne Nat'l Lab, Covestro LLC, ICF, NRG Insulated Block, Renovate by Berkowitz, Rmax Operating, Quadlock, and Solaria	

# Progress and Accomplishments: Going after 5.81 Quads of Energy Savings Potential



## Windows & Attachments

- Demonstration of commercial **R5 windows**: OptiQ™ Ultra Thermal Window
  - 40% better thermal performance (U-value)
- Drafted **M&V protocol** for documenting demonstrations
- Drafted framework for a **dynamic glass performance specification**
- Elected to **Attachment Energy Rating Council (AERC)** Board of Directors

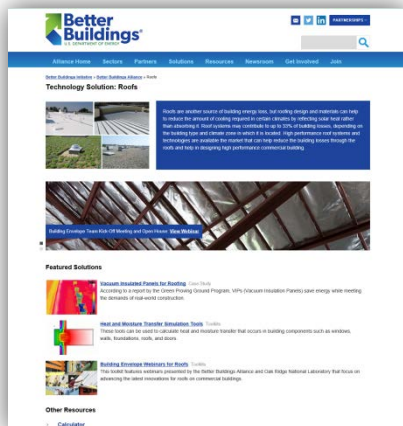


## Walls/ Air Barrier Technologies

- Demonstration of **air barrier technologies**
  - LIQUIDARMOR flashing and sealant
  - 3M self-adhered membranes
- Conducting **market study of methods for measuring air leakage** in commercial buildings
- Identifying BBA Partners' **best practices in air barrier implementation**

## Roofs

- Published **core resources** to advance roofing technologies
  - Cool Roof **calculators and guidance**
  - **Case studies**
  - Heat and moisture **transfer simulation tools**
- R&D for Modified Atmospheric Insulated (MAI) Panels



# Project Integration and Collaboration: Large and Diverse Group of Stakeholders

## Key Roles

### **ORNL Staff and Experts:**

- Manage Envelope Technology Team, develop resources, and provide technical expertise for members

### **BTO/CBI Program:**

- Provide leadership in advancing BTO mission

### **BBA & BBC Partners:**

- Recruit building owners/managers to participate in Envelope Tech Team activities and support collaboration among network

### **BBA Tech Solution Teams:**

- Coordinate with sister labs on outreach and communications with BBA Partners

### **A&E Firms:**

- Recruit to participate in Envelope Tech Team discussions and deployment of technical resources

### **Trade Associations:**

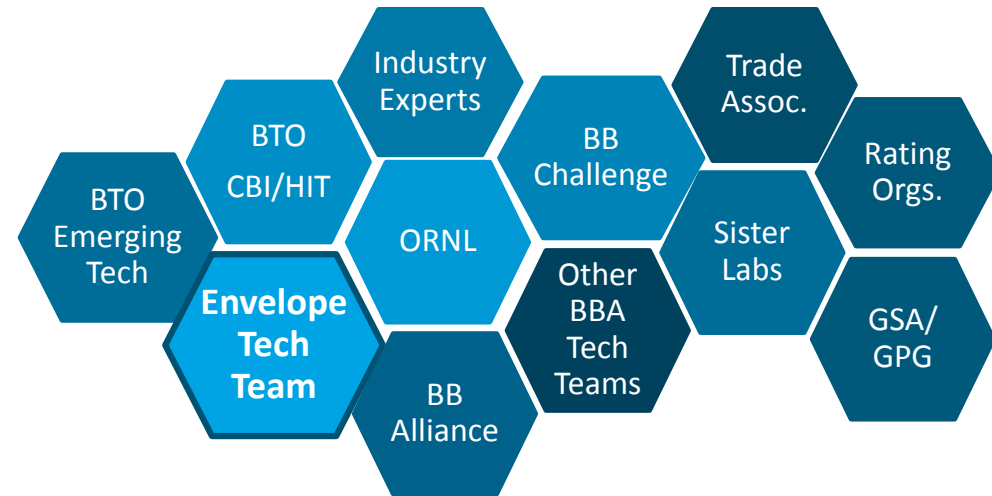
- Engage Air Barriers Association of America (ABAA), Exterior Insulation & Finishing Industry (EIFS) Member Assoc. (EIMA), and Single-Ply Roofing Industry (SPRI) in review and deployment of Envelope Tech Team resources

### **Rating Organizations:**

- Engage Attachments Energy Rating Council (AERC) and National Fenestration Rating Council (NFRC) in review and deployment of Envelope Tech Team resources

## Presenting at Industry Conferences:

- Buildings XIII International Conference: Dec '16
- ASHRAE Winter Meeting: Jan-Feb '17



# Next Steps and Future Plans: Enabling Investment in Envelope Technology Projects

## Conduct 1 to 2 Technology Team Meetings

- ✓ Envelope Tech Team Meeting: March 28
  - Focus: air barriers technologies & practices
- ✓ Sessions at BB Summit: May 16-17
  - Hidden in Plain Sight: presenting on Tech Team resources, including air barriers
  - Stranger Things: presenting on emerging window and wall technologies
  - Ask-an-Expert Sessions, lead by ORNL staff

## Develop 1 to 2 Technical Resources

- ✓ Air Barriers Market Practices Report
  - Gather info to support building owners/managers and A&E firms in addressing building code airtightness requirements for envelopes
- ✓ Identify (and possibly pursue) Team Member identified resource needs (specifications, guidance, case studies, etc.)

**Achieve FY17 Milestones**

## Strengthen Technology Team Actions and Catalyze Market Adoption

- ✓ Recruit and support additional members, specifically among building owners/managers
  - Provide expert tech assistance
- ✓ Engage Team members in development and use of technical resources
  - Deploy technology toolkits for windows, walls, and roofs
- ✓ Support technology demonstrations
  - R-5 windows
  - Air barrier technologies
- ✓ Build awareness of envelope technologies
  - Update the Technology Solutions Team webpages with relevant research and resources
  - Calculate energy savings claims and support DOE in their documentation

**Demonstrate Technologies**



# REFERENCE SLIDES

## Project Budget:

# Envelope Technology Solutions Team

**Project Budget:** \$1,085,000

**Variances:** None

**Cost to Date:** \$416,377

**Additional Funding:** None

## Budget History

FY 2015 – FY 2016 (past)		FY 2017 (current)		FY 2018 – FY 2019 (planned)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
\$425,000	\$0	\$220,000	\$0	\$440,000	\$0

# Project Plan and Schedule: Envelope Technology Solutions Team

Project Schedule																
Project Start: October 1, 2014					Completed Work											
Projected End: September 30, 2019					Active Task Work in progress											
				◆	Milestone/Deliverable (originally planned)											
				◆	Milestone/Deliverable (actual)											
				FY 2015				FY 2016				FY 2017				FY 2018-19
				Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sept)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sept)	Q1 (Oct-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sept)	
Task																
Past Work																
Q3: Envelope Stakeholder Workshop						◆										
Q4: Stakeholder Webinar Series										◆						
Q1: Kick off Tech Team												◆				
Q1: Launch Solutions Team Website												◆				
Current/Future Work																
Q2: Conduct Team Mtg													◆			
Q3: BB Summit														◆		
Q4: Conduct Team Mtg															◆	
Q4: Finalize Air Barriers Market Rpt															◆	
FY 2018-19: Engage and enable Team																