

# **2017 ILO Summit Presentations**

**July 26<sup>th</sup> - 28<sup>th</sup> , 2017**

**North Carolina State University**

**Raleigh, NC**



# Sustainability Planning For Post Graduation

Presented by:

Lisa Beard

Industry Outreach Director

And Liaison Officer

July 27, 2017



Northeastern



Rensselaer

TUSKEGEE

# Sustainability Overview

## CURRENT Post-Graduation Planning

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### **Purpose**

- Transition strategy for CURRENT to move from a NSF/DOE jointly funded ERC to a self-sufficient organization
- Secure additional support/funding for continuation beyond year 2020
- Four-year business plan/roadmap to outline necessary steps for implementation
- Engage stakeholders in planning process

### **What is needed to transition to self-sustained institute**

- Leadership of the management team
- Broad engagement of faculty, staff, industry partners, and university administration, which allows for both ownership in the plan and commitment from all stakeholders
- High degree of University commitment
- High education program value to faculty, students and industry
- Commitment of core group of faculty
- Active industrial support, contribution of membership fees and guidance
- Effective implementation of a transition plan that builds on Center's strengths

# Sustainability Planning Process

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- Initiated discussions with potential partners and funding sources
  - Reviewed other successfully graduated center's sustainability plans
  - Conducted one-on-one meetings with principal and key members
  - Ask for input during IAB workshops and retreats
  - Held Internal discussions with Leadership across Universities to gain institutional support
  - Developed action plan to procure resources including State Funding, Endowments  
e.g. NYSERDA, UT Center of Excellence, Gov. Chair  
e.g. Gates Foundation
- Formed the CURENT Industry Sustainability Working Group (CISP)
- Met with NSF ILO Consultants at UTK in April 2017 to discuss Center Sustainability Planning and Tech Transfer
- Presented and discussed CISP progress with IAB/SAB during July 2017 summer retreat
- Establish cooperative efforts with multi-disciplinary partners at CURENT Universities
- Working with two, small, start-up companies for technology transfer (option to license)
- Launch Core projects during Years 9 and 10
- Seek support to continue beyond Year 10
- Develop Plan for Education and Outreach Continuation

# CURRENT Industry Sustainability Planning Group (CISP)

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- **Team Purpose**
  - determine methods to retain and grow relationships with current members and explore other opportunities to help sustain the center.
  - help center build a sustainable model by providing guidance for financial support and facilitation of its programs.
- **Mission and Objectives**
  - increase the likelihood of a successful transition so Center is able to sustain itself (both its mission and budget) and continue to operate after graduation.
  - anticipated that several key changes can be expected for the Center. The goals of the plan is to positively manage those major changes and develop creative approaches to augment the core programs of the Center in other ways.

# CURRENT Sustainability team

CURRENT Sustainability Team	
Name	Affiliation
<b>Industry</b>	
Tom King (chair)	UT/ORNL
Hongming Zhang	Peak Reliability
Dejim Lowe	Tennessee Valley Authority
Xiaoming Feng	ABB/IAB Co-chair
Dave Bertagnoli	Scientific Advisory Board
Matthew Gardner	Dominion/IAB Chair
Phil Overholt	Department of Energy
<b>Faculty</b>	
Ali Abur	NEU Campus Director
Joe Chow	RPI Campus Director
Fran Li	UTK Campus Director
Greg Murphy	TU Campus Director
Bill Dunne	College of Engineering, Associate Dean & Professor
<b>Staff</b>	
Lisa Beard	Industry Outreach Director

# Sustainability Plan

## Four Key Components

### 1. Programmatic

- Define Post-Graduation Mission & Goals

### 2. Financial

- Secure University Support
  - Institutional Support (financial)- written commitments from 4 Deans
  - Interdisciplinary research grants obtained from Federal and State agencies
  - Innovation Partnerships – education grants and start-up companies
- Continue to Increase Industry Engagement
  - 14 on-site visits to industry sites in 2016 and 8 in YTD in 2017
  - 35 members 5/30/2017 – goal is 40 or less
  - Consider modifying cost structure
- Capitalize on Technology transfer

### 3. Cultural

- Develop future workforce by educating students who are prepared to work as teams, to become entrepreneurs, and are cross-trained in power electronics and power systems;
- Build a cross-section with public-private partnerships and leverage both public and private funding;
- Seek technology innovation through research, development and application;

### 4. External

- Marketing/Action plan
- Conduct Outreach/Workshops





# Mission and Goals

- CURRENT's mission is to be a critical catalyst for the technical evolution of the power industry. Several key changes expected for the Center:
- Goal of the sustainability plan is to positively manage those major changes and develop creative approaches to augment the core programs of the Center in other ways. The plan will address the following areas: 1) financial, 2) programmatic, 3) cultural and 4) external.
  - Metrics of success include the ability to maintain the core Center characteristics of system driven approaches and the core elements of industry engagement, research and education.

*Key Challenge will be balancing scope and availability of resources*





## Activities Across Different Time Dimensions



### **Innovation** (Long-Term, 10-20 yr)

- Identify and research top technology trends (ten to twenty year timeframe) with emphasis on enabling scalable, power-industry positive impacts
- Develop and publish a series of high-priority technology white papers for Members
- Develop attractive proposals and experiments in an effort to support long-term industry innovation and assure future investment
- Build a strategic technology portfolio (patents, licenses, etc.) to provide incremental independent funding while also providing value to Members

### **Research and Development** (Mid-Term 3-5yr)

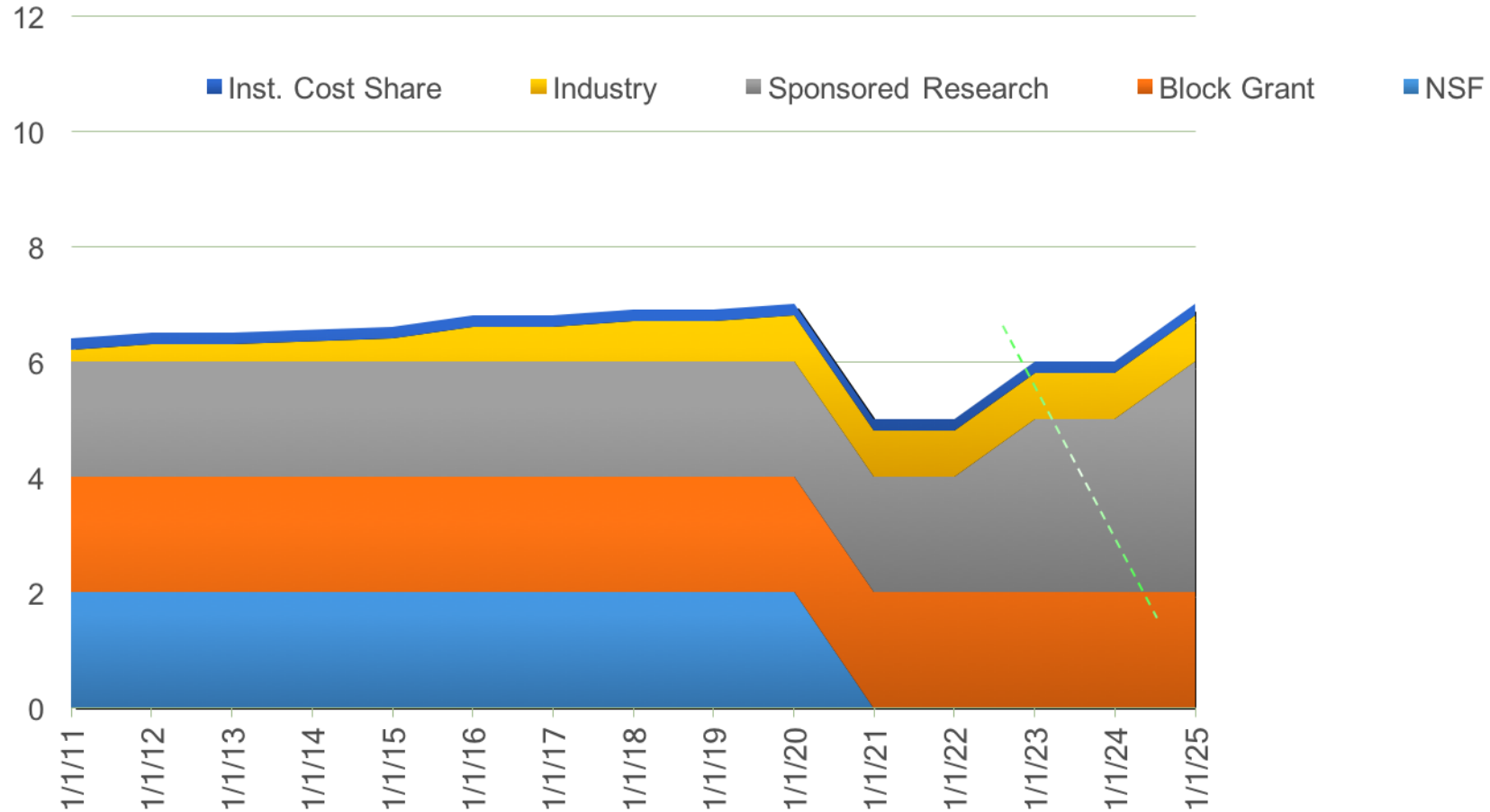
- Grow core competence in technology areas such as Ultra-Wide-Area Management, Monitoring and Measurement, Cyber Security, Large Scale Modeling, Analytics and Visualization
- Working closely with top tier Members Power

### **Technology Transfer** (Short Term 12-24 months)

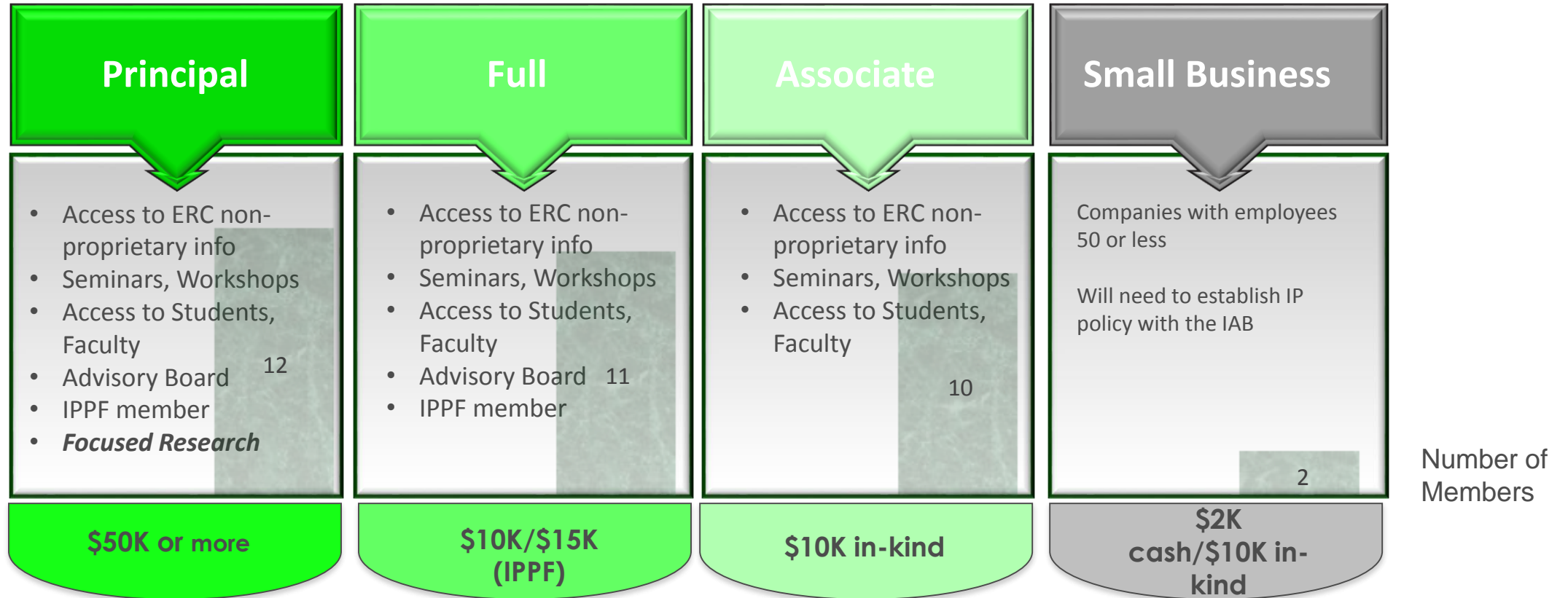
- Technology Testing/User Group(s)
- Software tool development and prototype design
- Annual Industry Conference
- Communications

# Post-Graduation Business Plan

## Draft Funding Plan (notional)



# Membership Structure



Our Sustainability Plan will focus on Principal and Full Memberships

- Increase principal/full membership participation
- May consider modifying membership fees
- May consider developing focused membership groups/projects

# Sustainability Plan

## Innovative Stakeholder Partnership – States, Federal opportunities



Cherokee Farms Innovation Campus, adjacent to UT campus, is being considered as a location for a multi-institutional collaborative that could leverage CURENT research activities

- Continue to pursue State and Federal funding opportunities
  - NYSERDA
  - Massachusetts
  - Alabama
  - Tennessee
- Innovative Stakeholder Partnership: e.g. Cherokee Farm Innovation Campus is a collaborative effort of The University of Tennessee and Oak Ridge National Laboratory.
- Aggressively pursue opportunities with DOD, DHS, DOE

# Capitalize on Technology Transfer & Intellectual Properties

## Commercialization paths

- Continue strong partnerships and collaboration with industry
- Increased financial assistance from each of the partner Universities and industry,
- Transfer of technologies to industry, business and marketing plans being implemented utilizing research expertise of the center's faculty, testbeds and research facilities.

## Technology commercialization roadmap



## Commercialization paths

FEATURES	EXAMPLES	COMMERCIALIZATION PATHWAYS	TECHNOLOGY APPROACH
Component & Devices	<ul style="list-style-type: none"> <li>• Next Generation Monitoring</li> <li>• Actuation Systems</li> <li>• Power Electronics</li> </ul>	<ul style="list-style-type: none"> <li>• Generate Intellectual Property &amp; Collaborate with Innovation Partners</li> <li>• Member Co. License</li> <li>• Small Business License</li> <li>• Start-up Company</li> </ul>	<ul style="list-style-type: none"> <li>• Device development</li> <li>• Modeling system impacts</li> <li>• Hardware test-bed demo</li> <li>• Field trial</li> <li>• Full deployment</li> </ul>
Software	<ul style="list-style-type: none"> <li>• Control Algorithms</li> <li>• MOVARTI –Volt/Var</li> <li>• Situational Awareness</li> </ul>	<ul style="list-style-type: none"> <li>• Member Co. License</li> <li>• Small Business License</li> <li>• Start-up Company</li> </ul>	<ul style="list-style-type: none"> <li>• Algorithm development</li> <li>• Modeling system impacts</li> <li>• Incorporate into commercial product or open-source</li> <li>• Field trial and full deployment</li> </ul>
User Facility	<ul style="list-style-type: none"> <li>• Hardware Test-bed</li> </ul>	<ul style="list-style-type: none"> <li>• ERC Consulting</li> <li>• Start-up company</li> </ul>	<ul style="list-style-type: none"> <li>• Define problem with client</li> <li>• Develop scenarios for HTB</li> <li>• Results communicated to client</li> </ul>

# I-CORP Program – Develop Business Model Canvas

Participated in UAB Regional ICORP Process – June 2017  
 4 weeks, 19 interviews, no additional funding

Focused on left side of canvas

## The Business Model Canvas



# Action Plan

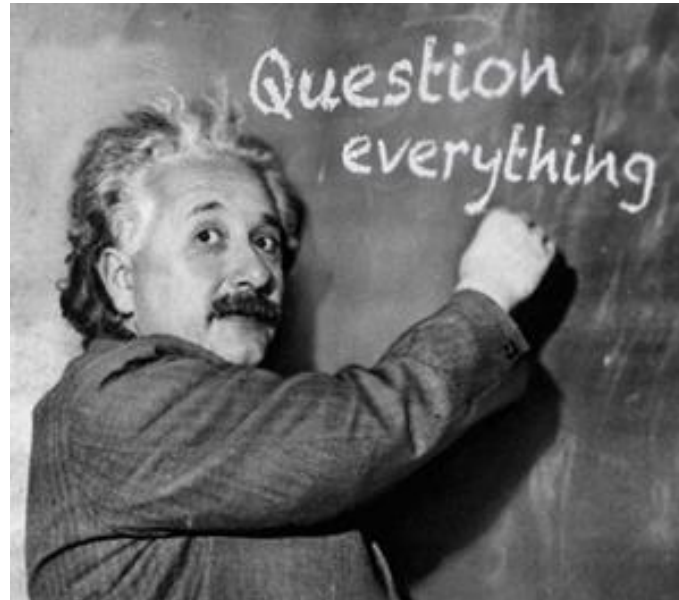
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- CURENT Industry Sustainability Plan Working Group/Plan
- Continue CURENT Research Outside of NSF/DOE ERC
- Extend CURENT Roadmap for Post Graduation
- Develop Business Plan (operating expenses/projected revenue)
- Work with three “technovators” for technology transfer
- Measures of Success
  - Secured financial assistance
  - Interdisciplinary research grants obtained from Federal and State agencies
  - Adopted technology developed business and marketing plans
  - Re-defined scope of the research portfolio
  - Fee structure established and being used for outside use of testbeds and research facilities transfer models
  - Continue Education Outreach Efforts



# Discussion

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# Acknowledgements

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***Other US government and industrial sponsors of CURENT research are also gratefully acknowledged.***



# Recruiting and Retaining New Members at NSF ERCs

R. Casey Boutwell, Ph.D., MBA  
Director of Industry Engagement  
2017 NSF ILO Summit  
July 27, 2017 – Raleigh, NC



# Outline

- ▶ Needs/Value Analysis
- ▶ Benchmarking /Landscaping
- ▶ Contact
- ▶ Resonance

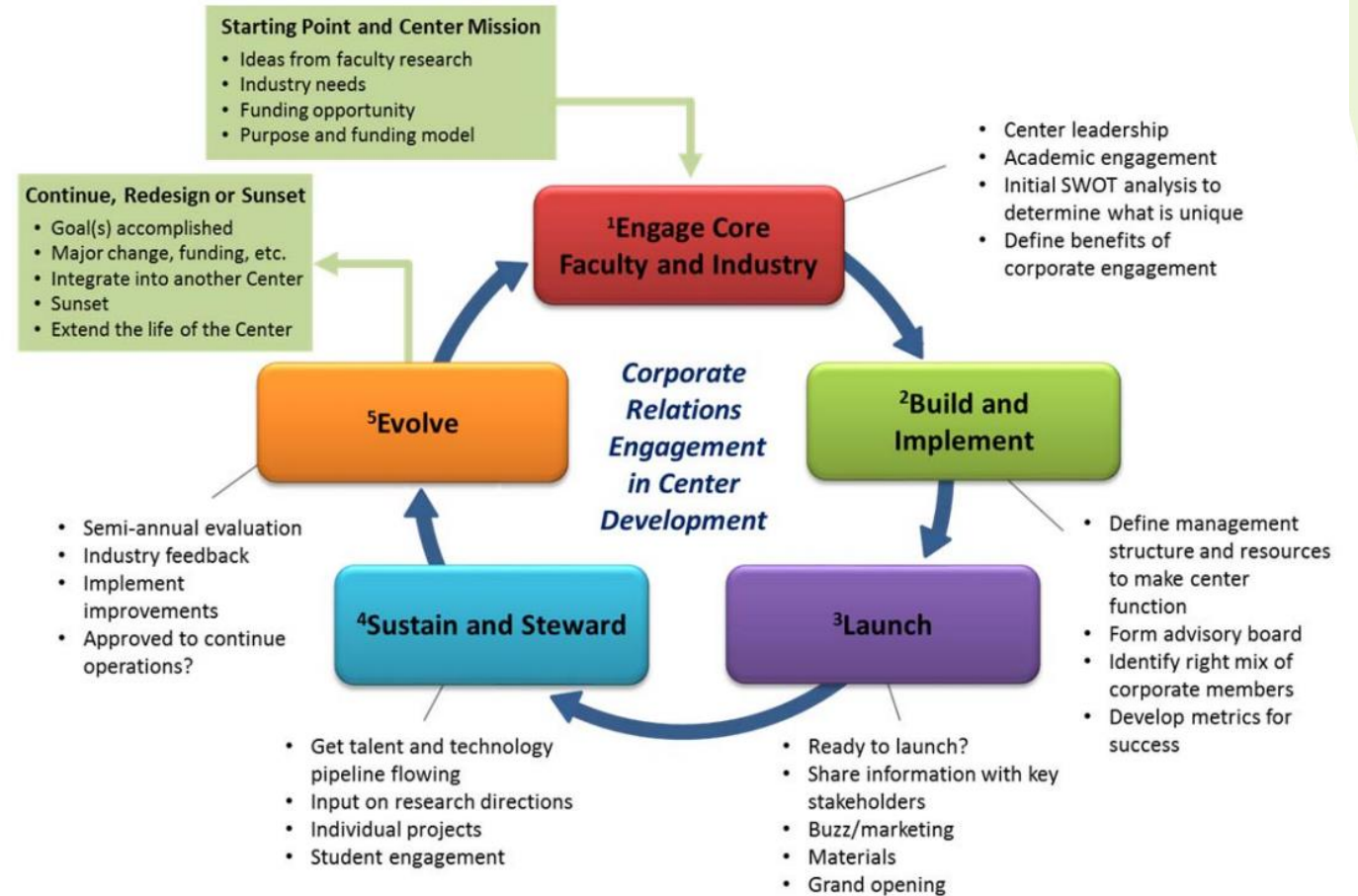


Figure 1 - Center Development Cycle

# ASSIST Industry Members in 2017

## Full Members



MERCK



## Associate Members



HANES  
Brands Inc



JSR Corporation



NOVEN  
PHARMACEUTICALS, INC.



muRata  
INNOVATOR IN ELECTRONICS

EASTMAN



MAS  
CHANGE IS COURAGE

## Affiliate Members



profusa



VALENCELL

psikick  
Ultra-Low-Power Wireless



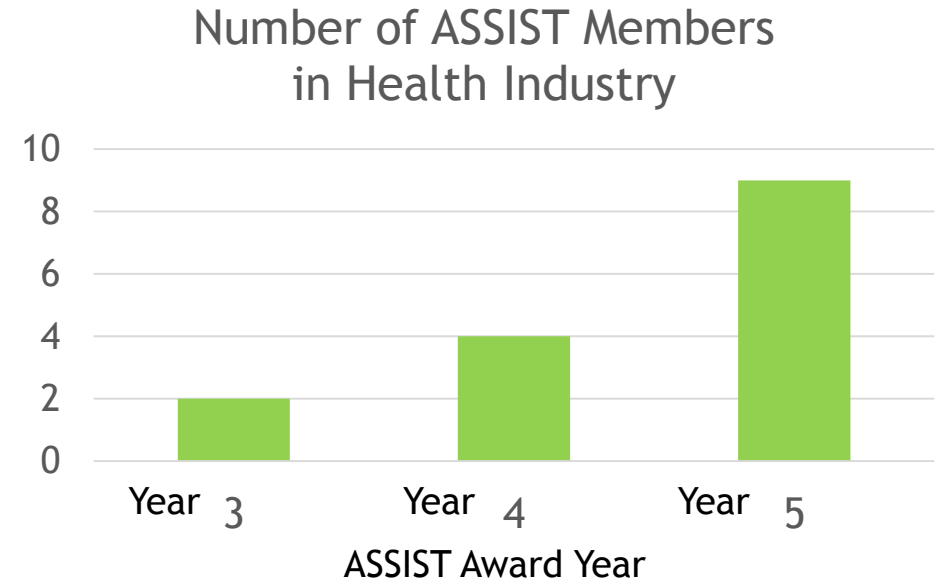
GLOBAL  
COMM WEAR, INC.



ASSIST

# Industry Membership

- ▶ Growth in health sector
  - ▶ Pharmaceuticals
  - ▶ Medical Devices
  - ▶ Systems
- ▶ Evaluation
- ▶ Engagement
- ▶ Advocates for ASSIST



8/21/201



# Active Membership Recruitment

- Seeking companies to help support growth
- ASSIST's needs change as our technologies develop
- Flexible electronics, IoMT, and medication adherence
- Target members:



# Needs/Value Analysis

- ▶ High level needs analysis of ERC
  - ▶ Next level of growth for ERC (research or development-wise) (CEO)
  - ▶ Site Visit Team key questions (CSO)
  - ▶ Input of new stakeholders, rounding out technology offerings (CCO)
  - ▶ Testbed development and broader deployment (COO)
- ▶ Skill/values analysis of faculty/leadership
  - ▶ Development capabilities and interests
  - ▶ Laboratory tools, throughput volume, student skills/development

# Benchmarking/Landscaping

- ▶ Characterization of the ERC value chain (where do research products go?)
  - ▶ What innovation or materials lead the Center's use?
  - ▶ Who is the next natural owner of the Center's research product outputs?
  - ▶ Who else captures value in the supply chain as Center outputs progress towards the end user?
- ▶ Landscape analysis of main industry sector(s)
  - ▶ What firms are leading in your sectors? What firms have a **growth mentality**?
  - ▶ Big cash rich companies (sponsored research)
  - ▶ Mid-size companies with high press coverage and rapid growth (research and development)
  - ▶ Small companies with VC backing and experienced teams (co-development on specific projects)
- ▶ Identifying the right member firm



# Contact

- ▶ Identifying the right contact

- ▶ ILO needs bizdev/exec/director contact
- ▶ PI needs engineering contact



- ▶ Expanding the contacts (finding engineering and business leads who know each other)

- ▶ ILO pitches to bizdev team
- ▶ ILO hosts call with engineering lead and key PIs
- ▶ Host Center visit for both technical and business contacts

# Resonance

- ▶ Keeping the relationship growing, stakeholder weigh-in/buy-in
- ▶ Incorporation on larger projects/responsibilities ASAP (more in IAB Role)
- ▶ Building metrics for success:
  - ▶ In-person visits
  - ▶ Joint calls
  - ▶ Papers/presentations emailed
  - ▶ IP disclosed in field
  - ▶ Press coverage
  - ▶ Students/faculty hired
  - ▶ Connections to other members/customers
  - ▶ Private presentations/visits by students/faculty
- ▶ Circle back frequently for check-up, happy with engagement, new needs/opportunities?

# Examples

- ▶ **Noven Pharmaceuticals:** ILO identified lead, pitched business teams, built support top-down
- ▶ **Profusa Inc:** PIs identified lead, pitched co-development projects, awarded shared grants, built support bottom-up
- ▶ **Bluedoor:** Partnership/community identified, active in shared goals, supporting Center growth
- ▶ **VitalFlo Inc:** Commercialization identified, supporting specific individual growth/license



# Group Dialogue

- ▶ How many members do you each have?
- ▶ How many members gained/left last year?
  - ▶ Do you see this trend continuing?
- ▶ Who is your greatest internal advocate?
- ▶ Who is your greatest external advocate?



# The Role of the Industrial Advisory Board at NSF ERCs

R. Casey Boutwell, Ph.D., MBA  
Director of Industry Engagement  
2017 NSF ILO Summit  
July 27, 2017 – Raleigh, NC



# Outline

- ▶ Step 0: ASSIST's IAB in Bylaws
- ▶ Motivation of the IAB (Philosophy)
  - ▶ Diversity, Advisement, Engagement
- ▶ Objectives for the IAB (Strategy)
  - ▶ Capabilities, Contributions, Advocacy
- ▶ Examples of Strategies (Execution)

# Step 0: How is ASSIST's IAB structured?

- ▶ Full and Associate Members (3 vs 1 vote each)
- ▶ Advise
  - ▶ Commercialization strategy, core/non-core mix
- ▶ Review
  - ▶ Reports, budgets, proposals, IP
- ▶ Votes
  - ▶ Membership-pool-funded projects, IP decisions
- ▶ ASSIST has 17 IAB Members, 5 Full and 12 Associate 5

# ASSIST Industry Members in 2017

## Full Members



## Associate Members



## Affiliate Members





# IAB Philosophy

- ▶ Diverse boards build a broad bench with deep expertise
  - ▶ 5 large, 10 medium, 1 small company
  - ▶ European, Asian, American headquarters
  - ▶ Textiles, Electronics, Pharmaceuticals, Materials, Data Analytics
  - ▶ General research vs specific projects



# IAB Philosophy

## ▶ Advisement

- ▶ Reviewing and providing context for project selection
- ▶ Answering strategic questions (Proj. X or Y? What after Proj. X? etc.)
- ▶ Clarifying ASSIST's place in the value chain for our field (who do we support, who supports us?)

## ▶ Engagement

- ▶ Finding new engineering contacts to support key PIs and key projects
- ▶ Supporting projects inside firm (for bizdev attention, partnerships, or intern selection)
- ▶ Challenging PIs and students (for relevance of work, for further funding, etc.)

# Strategies for the IAB

- ▶ Identifying capabilities of individual board members or firms (and recruiting missing needs, previous talk)
- ▶ Translating capabilities to contributions
- ▶ Mechanisms for inclusion:
  - ▶ Sub-chairs based on ERC needs
  - ▶ Taskforces for high priority projects
  - ▶ Technical calls with high performing PIs
  - ▶ Engagement with non-team players
  - ▶ Strategy calls with key IAB members
  - ▶ Advocacy for membership drive events



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**muRata**  
INNOVATOR IN ELECTRONICS



**NOVEN**  
PHARMACEUTICALS, INC.



سابك  
sabic



**EASTMAN**



**sas**

# Expanding IAB Leadership

- ▶ 3 sub-chairs: Data, Health, Self-sufficiency
  - ▶ Go-to connection for strategic questions
    - ▶ IAB Chair:
      - ▶ Anna Kravets
        - ▶ Director of Business Consulting
        - ▶ Merck & Co. - Pharmaceuticals
    - ▶ Health Adviser:
      - ▶ Anita Watkins
        - ▶ Director Rex Strategic Innovations
        - ▶ UNC Rex Healthcare – Healthcare Provider Network
    - ▶ Data Adviser:
      - ▶ Dr. Deva Kumar
        - ▶ Distinguished Systems Architect
        - ▶ SAS Institute – Data Analytics and Intelligence
    - ▶ Self-sufficiency Adviser
      - ▶ Currently open



# Examples: IAB Engagement at ASSIST

## ▶ External Advocacy

- ▶ New membership: target members respect existing member opinions, existing members invite target members to events
- ▶ To the NSF: explain realistic commercialization and IP objectives, describe useable outputs of research projects



## ▶ Internal Advocacy:

- ▶ Helps direct attention to areas ILOs feel of greatest need (great asset)
- ▶ Connect member engineering teams with holistic needs of Center, not just on their projects (benefits of systems center)
- ▶ General examples: commercialization, IP, partnerships, testbed development
- ▶ Specific examples: MDs, insurance companies, investors



# Examples: IAB Engagement at ASSIST

- ▶ Testbed level taskforces
  - ▶ Provides domain expertise, market intelligence, and engineering engagement
  - ▶ Grows multiple relations between members and PIs (stronger mesh)
  - ▶ Increases membership value for members and engagement value for PIs
- ▶ Hosting showcase and membership drive:
  - ▶ Profusa hosted ASSIST in SF, invited 40 companies to PI pitch rounds and demo review (gained two new members)
  - ▶ Analog Devices hosting similar event in September in Boston

# The role of the IAB at ASSIST

- ▶ The role of the IAB is to advise the Center Leadership.
- ▶ Advice and engagement is for research objectives supporting commercially relevant goals.

# Group Dialogue

- ▶ How many members are in your IABs?
- ▶ How is your IAB structured?
- ▶ What would you like to get out of your current IAB?
- ▶ What is the best-performing IAB we could create?
- ▶ What external stakeholders can we tap to help create this structure?

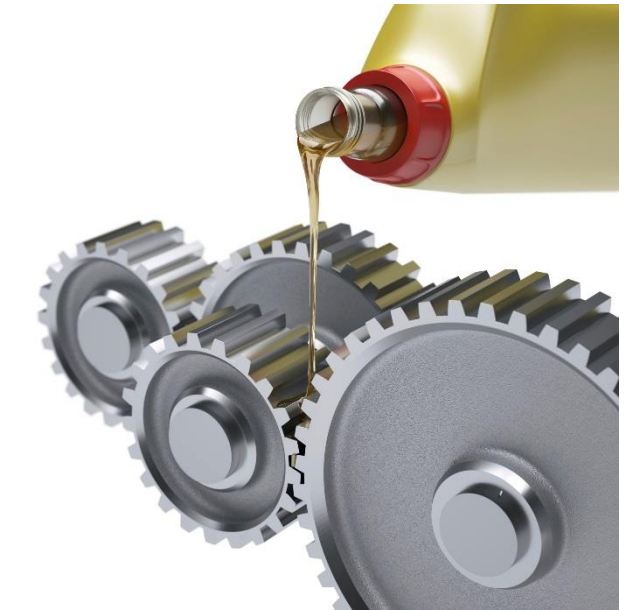


- ▶ Advocates for the Center, to the NSF, faculty, students
- ▶ Advising director and d.dir
- ▶ Task forces on center needs (data, health, sustainability, testbeds)
- ▶ Ask targeting questions:
  - ▶ “how do we leverage results of proj. x to be more effective and attractive to particular sectors or companies”
  - ▶ “should we focus more on data infrastructure in our research or can we leave that to industry as a solved problem (to just plug and play in the future)?”

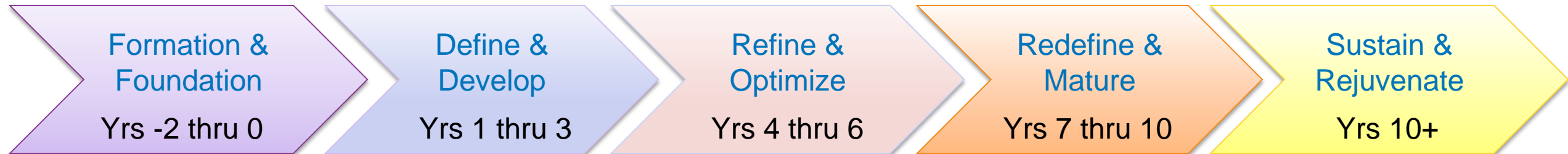
- ▶ Help find technical contacts for scientific advisory board, closely ties member to center.
- ▶ Providing material for incorporation in testbeds and research prototypes (benefits member and team)
- ▶ Supports ILO in membership searches externally for connecting to internships
- ▶ Supports ILO mission internally to advocate for industry focus and specific IP strategy,

# Recruiting and Retaining July 2017

Peter L Keeling  
Iowa State University



# Different Stages



ERC STAGES & YEARS CONCEPT	Stage 1. ERC Years -2 thru 0 Formation and Foundation	Stage 2. ERC Years 1 thru 3 Define and Develop	Stage 3. ERC Years 4 thru 6 Refine and Optimize	Stage 4. ERC Years 7 thru 10 Redefine and Mature	Stage 5. ERC Years 10+ Graduate to Sustainable Center
Ideation and Formation	Work closely with ERC Founders and University advisors to develop ideas within context of NSF ERC Guidelines. Help define ERC opportunity.	Define and develop ERC concept working closely with ERC Management Team.	Refine ERC concept working closely with ERC Management Team.	Redefine Center concept based around a vision of future sustainability.	Review and define new sustainability strategy.
Member Recruitment	Secure letters of intent from future industry members. Identify key individuals to work with.	Develop active outreach process through business connections, technical summits, outreach presentations, fairs and brochures. Tiered membership structure based on company size, varying benefits. What is a realistic IAB size.	Refine recruitment efforts with a greater emphasis on maximizing ability to retain key members.	Redefine recruitment and retention around a future sustainability strategy.	Develop connections to forge the best path into Sustainability.
Member Retention	Begin to define strategy to retain members through engagement in center activities including newsletters, webinars and other informational tools.	Develop company interaction and benefits. Develop ideas around joint projects, testbeds, and other ERC opportunities.	Maximize ERC / company interaction and benefits. Cultivate interest in joint projects, involvement in testbeds, and other ERC opportunities. Value and mechanisms of establishing multiple points of contact in firms.	Redefine recruitment and retention around a future sustainability strategy.	Develop retained connections to forge the best path into Sustainability.
Commercialization of IP	Begin to define testbeds and cross project integration alongside a strategy for commercialization.	Develop Industry/R&D needs alongside ERC needs in testbeds. Integrate industrial input from project inception, using project management tools (timelines, go/no-go points, cross project integration, etc.). Strategies for increasing sponsored research projects with industry.	Meet Industry/R&D needs alongside ERC needs in testbeds. Integrate industrial input from project inception, using project management tools (timelines, go/no-go points, cross project integration, etc.). Strategies for increasing sponsored research projects with industry.	Redefine commercialization strategy around a future sustainability strategy.	Redefine commercialization strategy in light of sustainability path.
Intellectual Property	Begin to define strategy for IP management and technology transfer.	Develop processes for management and strategy. Technology Transfer and the Invention Disclosure. Start to identify key technology transfer staff for ERC IP management (invention disclosures, patent processing, IP marketing, etc.), the licensing process and what is really valuable to the membership.	Refine management and strategy. Technology Transfer and the Invention Disclosure process. Realistic chances of "big hit" from IP generated revenue. Cultivate connections to key technology transfer staff for ERC IP management (invention disclosures, patent processing, IP marketing, etc.), the licensing process and what is really valuable to the membership.	Redefine intellectual property strategy around a future sustainability strategy.	Redefine IP strategy in light of sustainability path.
Innovation Strategy	Begin to identify key local innovation partners and infrastructure	Develop paths to entrepreneurship activities in the ERC and University, connecting to local, state, and regional economic development and incentive programs and role of investment groups such as Angels, VCs.	Cultivate entrepreneurship activities in the ERC and University, connecting to local, state, and regional economic development and incentive programs and role of investment groups such as Angels, VCs.	Redefine innovation strategy around a future sustainability strategy.	Redefine innovation strategy in light of sustainability path.
Education Programs	Begin to identify strategy to develop valuable education programs	Start student mentoring programs, short courses and workshops for industry. Certificate programs and distance learning models. Faculty and student exchange. Active promotion of industrial recruitment of graduates.	Refine student mentoring programs, short courses and workshops for industry. Certificate programs and distance learning models. Faculty and student exchange. Active promotion of industrial recruitment of graduates.	Redefine education strategy around a future sustainability strategy.	Redefine education strategy in light of sustainability path.

Members

Joined

Exited

2009 2010 2011 2012 2013 2014 2015 2016 2017

Larger  
^  
Medium  
^  
Smaller



Some Retained from Inception - 25 Exited - Mostly a changing business emphasis (Average Longevity ~4yrs)

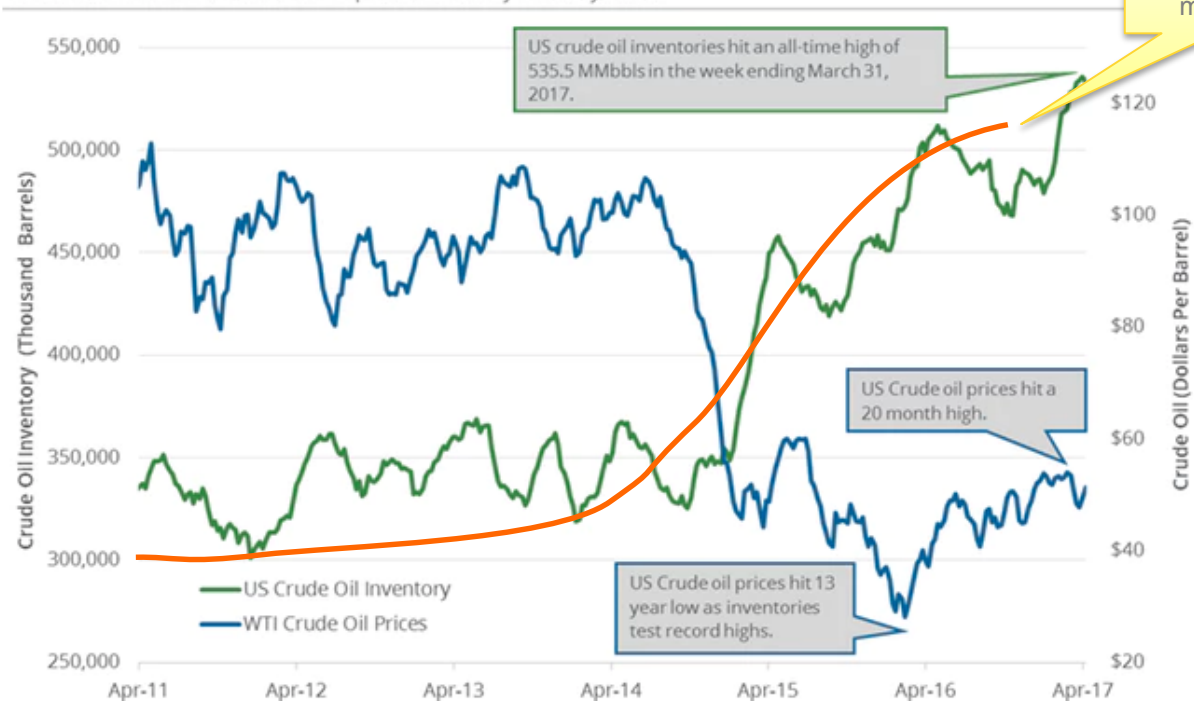


# Mega Trends

LUX: Amid low oil prices, investors have shifted focus in 2016 to commercializing biobased products that offer improved performance, not just “greener” replacements for petro-based compounds.

## Impact of US Crude Oil Inventories on Crude Oil Prices

US crude oil inventories and crude oil prices are usually inversely related



Source: EIA, NYMEX

Market Realist



Timeline

Biofuels

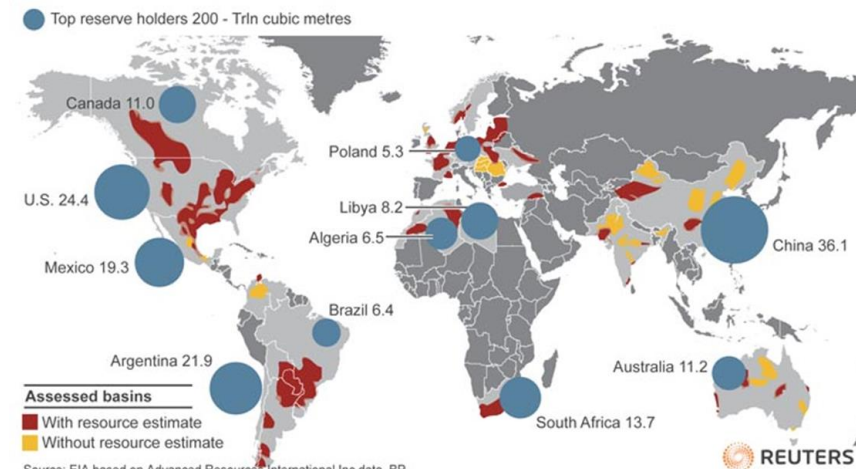
Biofuels  
Bioproducts

Biofuels  
Bioproducts  
Specialty  
Cosmetics

Biofuels  
Bioproducts  
Specialty  
Cosmetics  
Materials  
Composites

Biofuels  
Bioproducts  
Specialty  
Cosmetics  
Materials  
Composites  
Nutraceuticals  
Food

## Global shale gas basins, top reserve holders



Source: EIA based on Advanced Resources International Inc data, BP

Reuters graphic/Catherine Trevethan

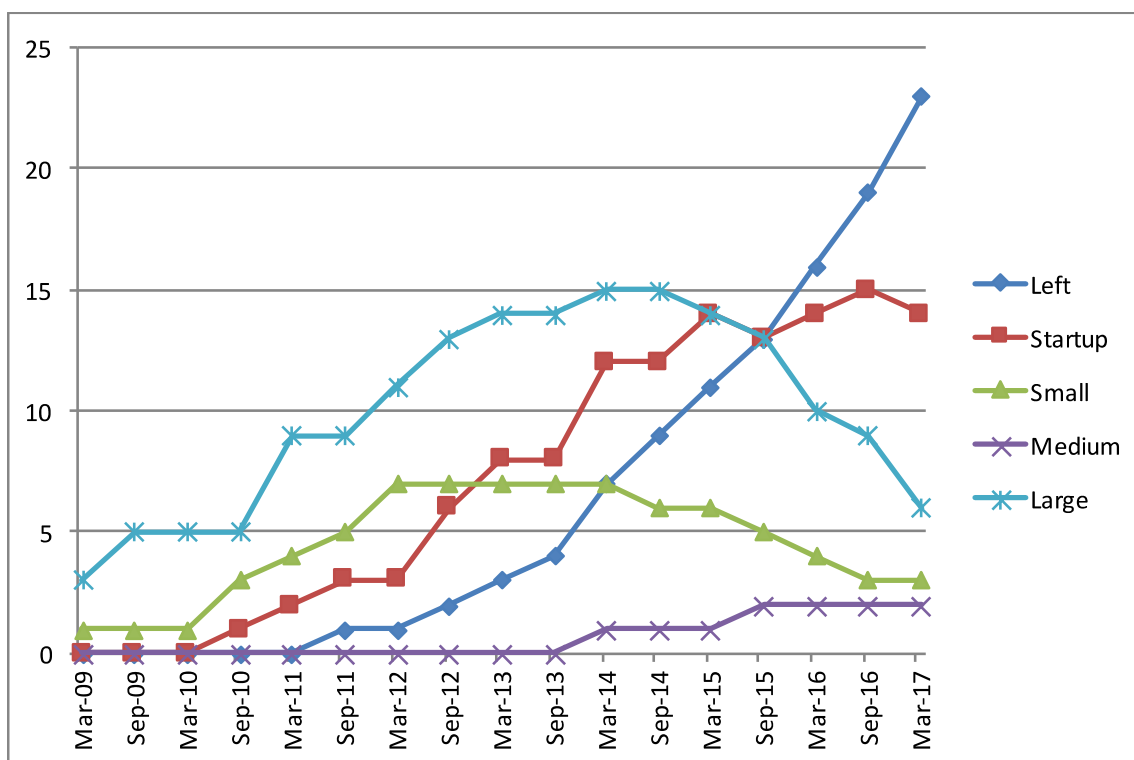
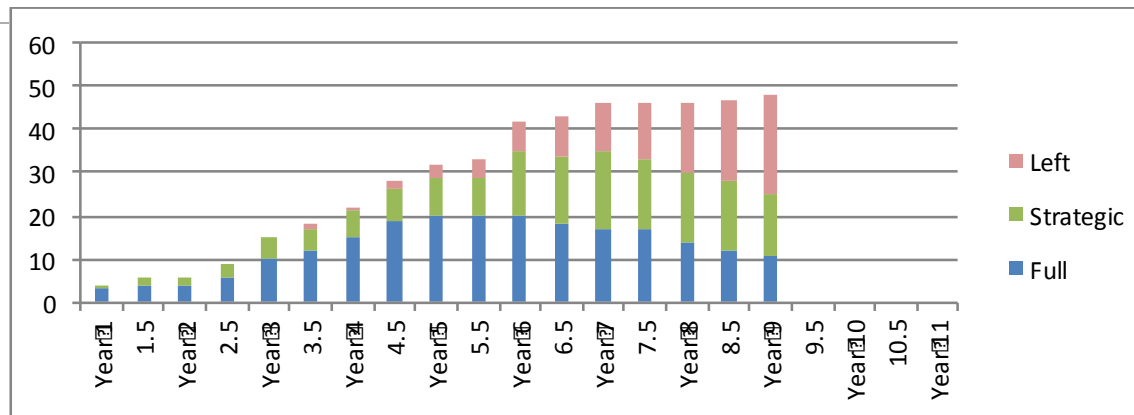
REUTERS



# One Year Away from Zero Members

- Members stayed between 1 year and 8 years
- Recruit, Reward, Retain.
- Stagger start/renewal date when sign agreement.
- Tiered membership offers valuable flexibility.

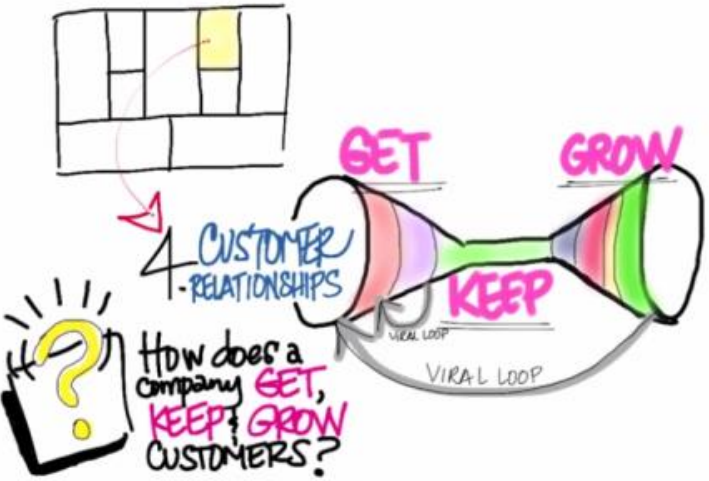
	<b>Strategic</b> No IP Options	<b>Full</b> Includes options to negotiate IP Rights	<b>Sponsoring</b> * To be negotiated on a case-by-case basis
<b>Large</b>	\$25,000	\$50,000	*
<b>Medium</b>	\$12,500	\$25,000	*
<b>Small</b>	\$2,500	\$5,000	*
<b>Startup</b>	\$500	\$1,000	*



# Attract & Retain

ERC's need an active IAB with sufficient diversity to add value to the center.

- Find
- Hire
- Train
- Engage
- Retain





# Find - Core Needs

Understand why companies are members. They are not all the same.

- Clear Understanding of Industry Membership Benefits & Costs, and your Membership Agreements
- Solid Knowledge of your ERC's Science & Technology
- Classy Brochure with your ERC Story
- Convincing PowerPoint Presentation with Great Slides



- Consistent Credibility with your ERC Management Team and University Admin
- Build Links to the Broad Industry of your ERC
- Dialogue & Good Relations with your Industry Member Folk
- Patience, Perseverance, Persuasion, Passion & Vision

# Track - Membership Database

Build a database of company names, connections, contact info and notes.

- Spreadsheet is a good start.
- Need to track member changes and evolving contact lists.
- Next level is a database. Best if database and invoices are integrated.
- ILO's that exit leave a challenge behind.



**Job Change Notifier** Like Follow @jcnotifier Login

Get an email alert when any of your LinkedIn connections change jobs.

- Stay up to date on your professional network
- Find out when your company's ally gets promoted, or when an obstacle decision-maker quits
- Learn when a person of interest resigns, gets poached, or gets acqui-hired

For: Sales/BizDev Execs | Startup Founders | Journalists | Professionals

[get started!](#)  Log in with LinkedIn

Created by Roger Lee







# Hire, Recruit

Recruit key decision makers. Industry folk move jobs. Track with LinkedIn.

- Emails, connections, business meetings lectures, brochures.
- Imperative to reach the “right person” as senior as you can get. Build many connections.
- Follow-up with conference call and campus visit.
- Invite select guests to Annual Meeting (Fee & CDA).



#### Your LinkedIn Network

**1,822** Connections link you to 12,033,416+ professionals

**17,225** New people in your Network since April 26

Add Connections

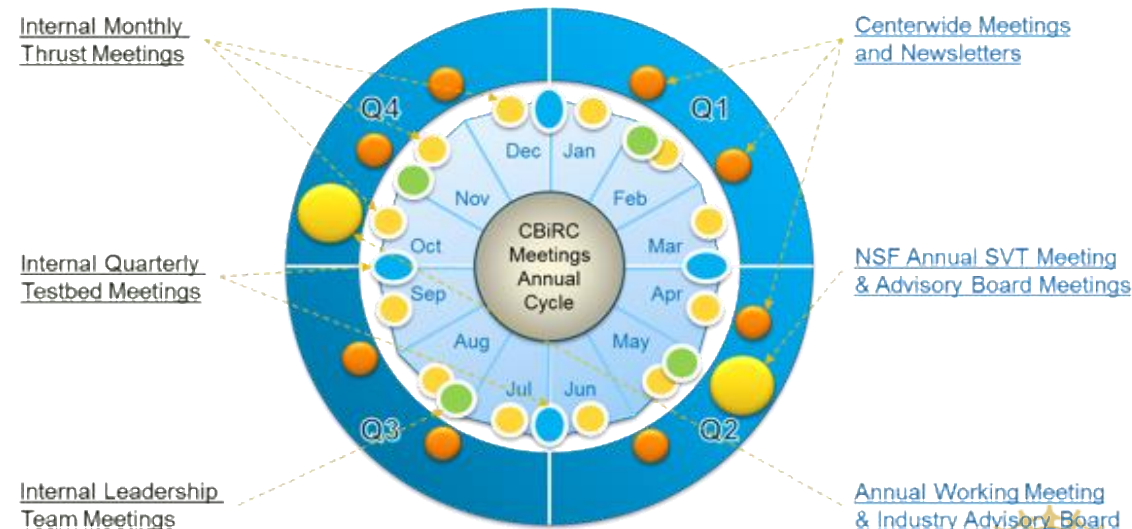
- Cold calls do not work.
- CDA is sometimes a problem.
- Use your IAB and Faculty.
- Business Summits

**7<sup>th</sup> Annual**  
**BIO-BASED & SUSTAINABLE PRODUCTS**  
**SUMMIT**

January 13-14, 2016 | San Diego Marriott La Jolla | San Diego, CA

# Train

- Explain, describe and summarize.
- Often get new people to member meetings.
- Legal side and patents and internet access and strategy and SWOT.
- Build a good rapport with your IAB.

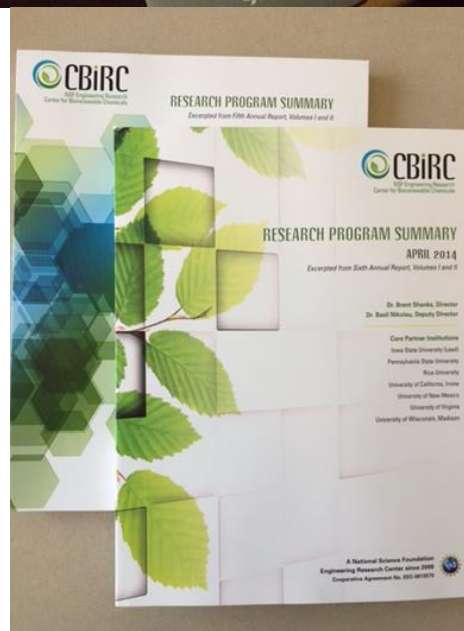


# Engage

Respond effectively to emails, phone calls, meetings, discussions, comments.

- Annual meetings are very important.
- Newsletters and webinars are very effective.
- Impossible to provide all information about an ERC to the membership.

Listen, Evolve, Professional



Strengths provides an area to list everything done right either individually or as an organization. This section contains both organization and external strengths, such as client relationships.

**S**  
STRENGTHS

Weaknesses are aspects of your business that detract from the value you offer or place you at a competitive disadvantage. You need to enhance these areas in order to compete with your best competitor.

**W**  
OPPORTUNITIES

Opportunities are factors that represent reasons your business is likely to prosper. Such as being able to expand a franchise into a new city, while some may fall into your lap such as another country opening up its market to foreign business.

**O**  
WEAKNESSES

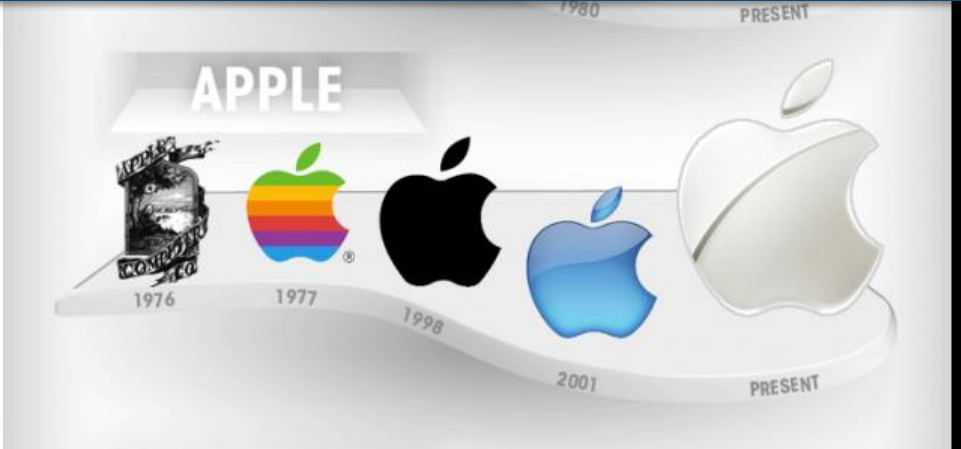
Threats include external factors beyond your control that could place your strategy, or the business itself, at risk. You have no control over these, but you may benefit by having contingency plans to address them if they should occur.

**T**  
THREATS

# Retain

Members that leave do not come back.

- Improve your program over time so that there is always a next level.
- Build multiple relationships with members.
- IAB Seed projects from membership fees.
- Sponsored research, internships, mentoring all build a deeper root in the ERC.
- Find creative ways to not lose members.



	Strategic No IP Options	Full Includes options to negotiate IP Rights	Sponsoring * To be negotiated on a case-by-case basis
Large	\$25,000	\$50,000	*
Medium	\$12,500	\$25,000	*
Small	\$2,500	\$5,000	*
Startup	\$500	\$1,000	*

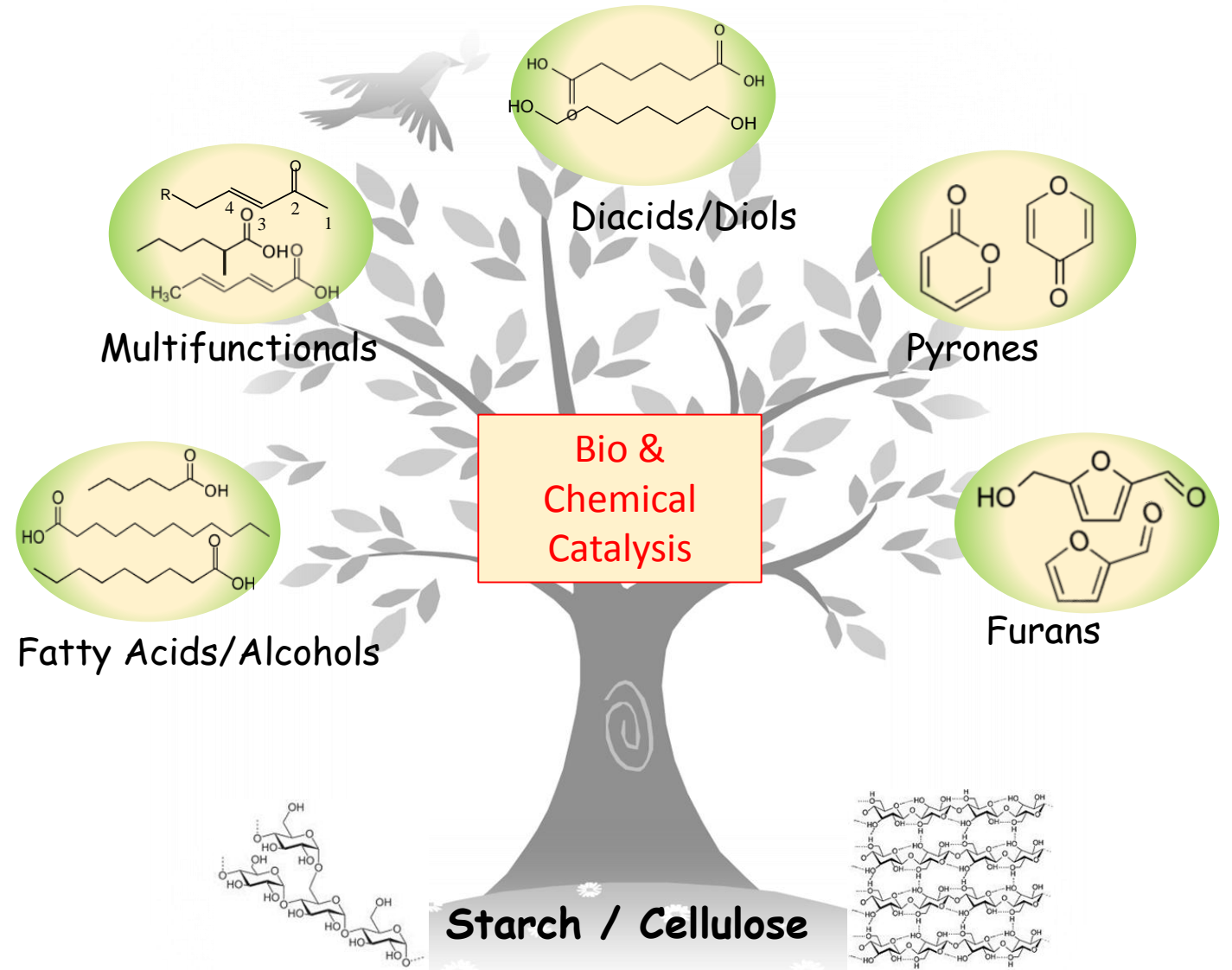
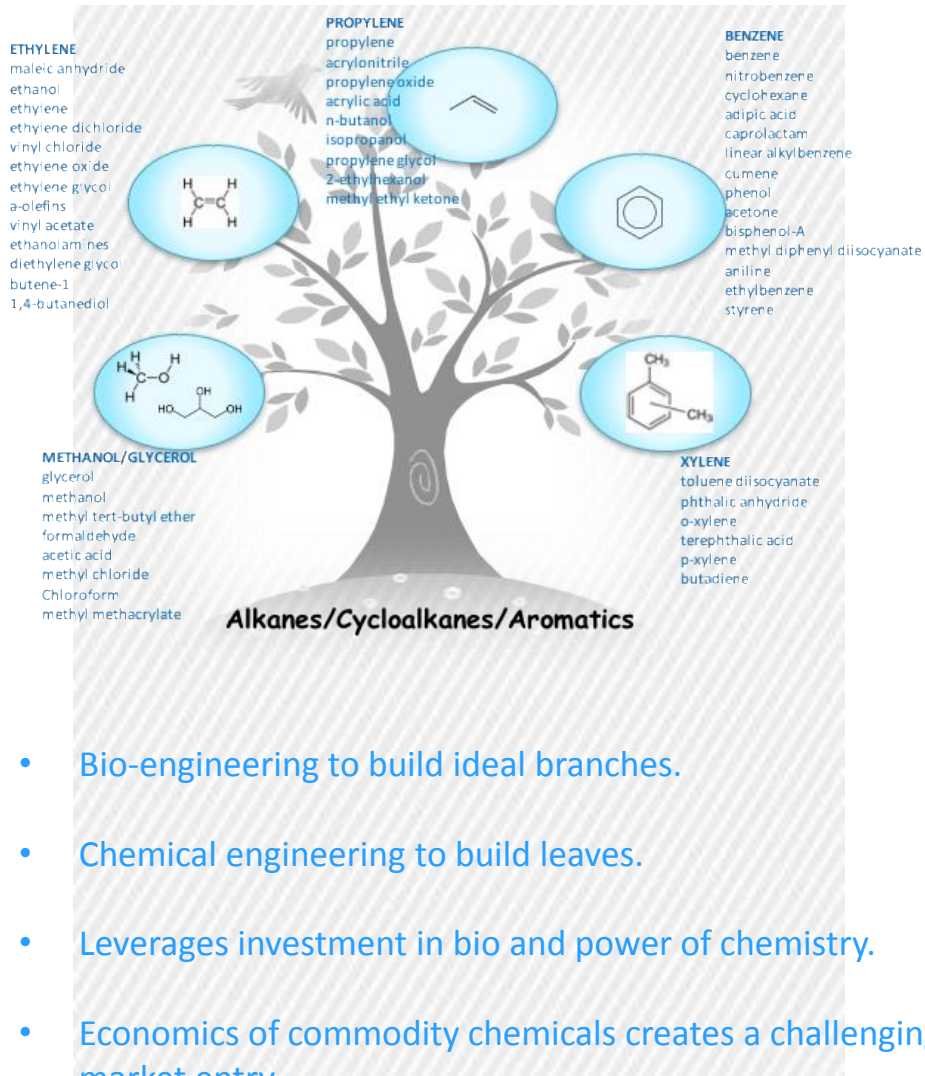


# Thank you!!

How will you innovate  
for a better world?



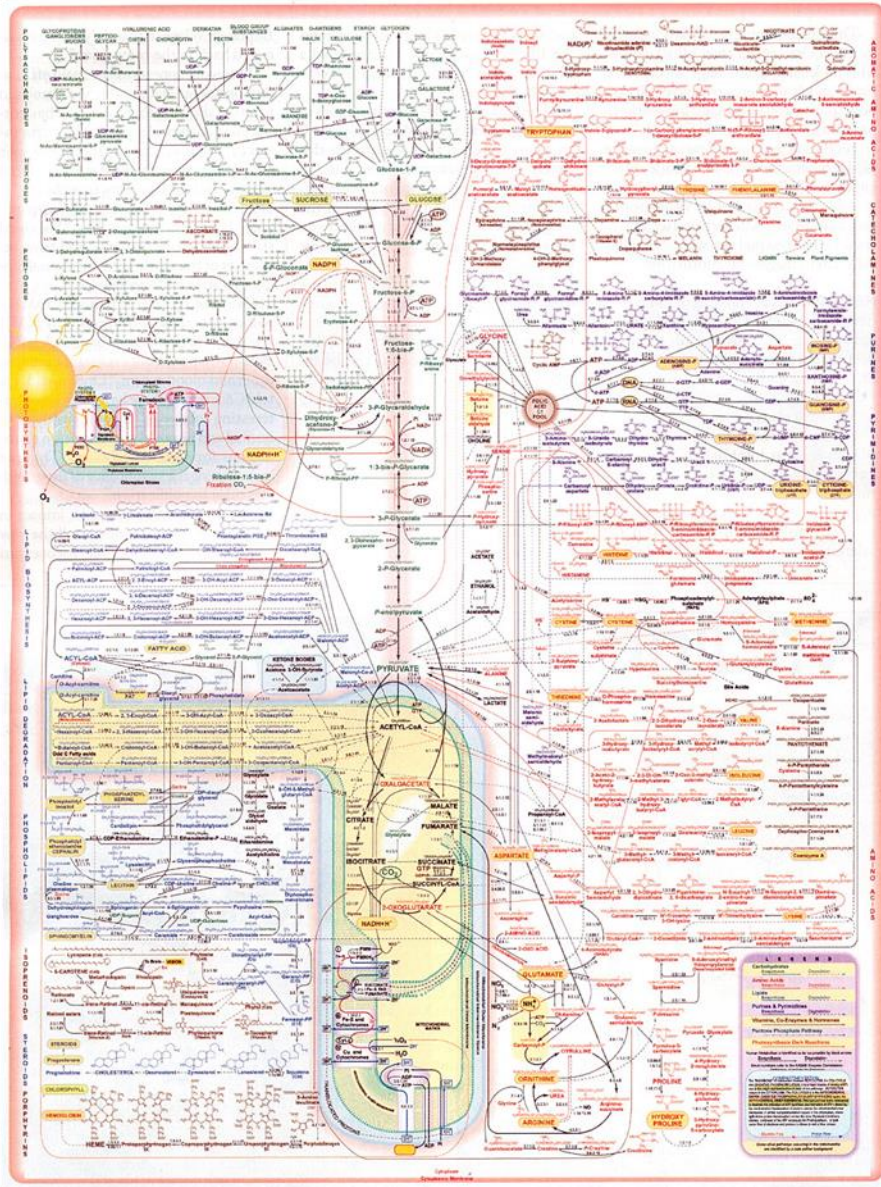
# Build Intermediates to make Branches



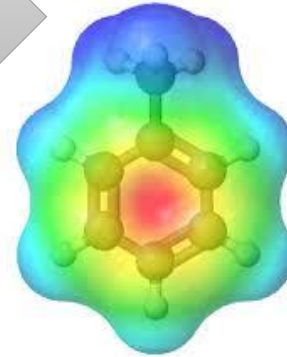
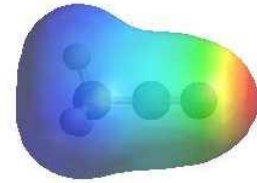
- Bio-engineering to build ideal branches.
- Chemical engineering to build leaves.
- Leverages investment in bio and power of chemistry.
- Economics of commodity chemicals creates a challenging market entry.



# Computational Biocatalysis



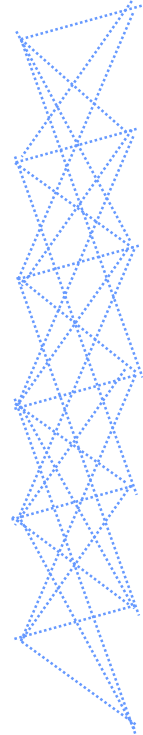
Ideal  
Intermediate  
Molecules



Biocatalysis

Chemical Catalysis

Platform Array of Molecules



Polymers

Resins

Personal Care

Surfactants

Lubricants

Composites

Materials

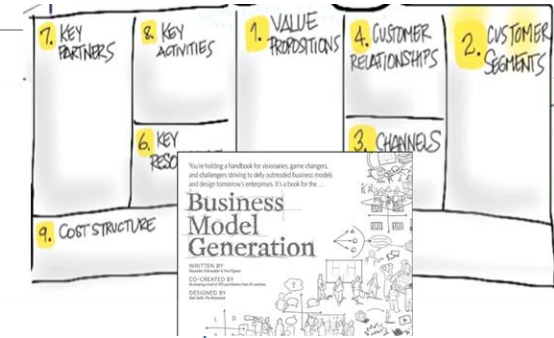
# Ecosystem Accelerator



**BIOBASED  
FOUNDRY**



**TECHNOLOGY - LED  
ENTREPRENEURSHIP**



- Students gain real insight into project and startup concept planning.
- At least one startup from each Entrepreneurship Course.
- Startups need mentoring and require funding.
- CBiRC's startups have accessed over \$6m of funding since 2011.

 **GlucanBio**

 **sus/erea**  
Biorenewables

 **Pareto**  
Biotechnologies

**VariFAS**  
Various Fatty acids and Derivatives

 **OmegaChea**

 **TECHNOLOGY  
HOLDING**  
SUSTAINABLE SOLUTIONS

**CERIUM**

 **Sumatra**  
Biorenewables

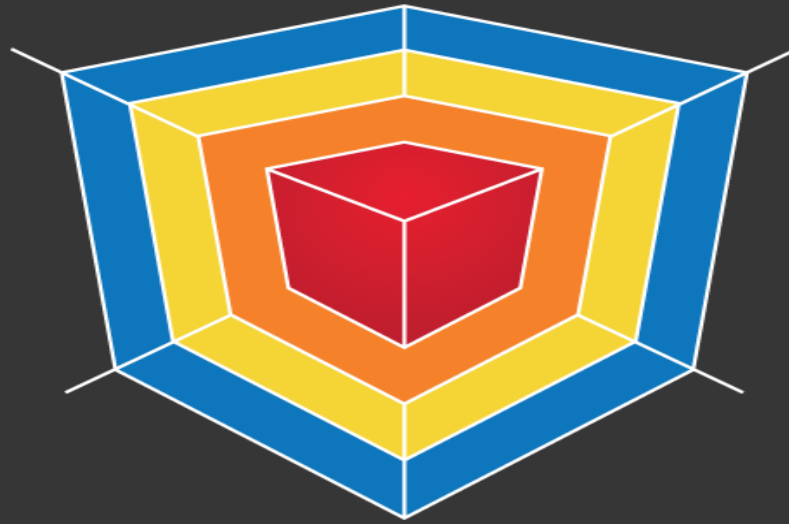
 **ESTose Biorenewables**

# ERC Stages

ERC STAGES & YEARS CONCEPT	Stage 1. ERC Years -2 thru 0 Formation and Foundation	Stage 2. ERC Years 1 thru 3 Define and Develop	Stage 3. ERC Years 4 thru 6 Refine and Optimize	Stage 4. ERC Years 7 thru 10 Redefine and Mature	Stage 5. ERC Years 10+ Graduate to Sustainable Center
Ideation and Formation	Work closely with ERC Founders and University advisors to develop ideas within context of NSF ERC Guidelines. Help define ERC opportunity.	Define and develop ERC concept working closely with ERC Management Team.	Refine ERC concept working closely with ERC Management Team.	Redefine Center concept based around a vision of future sustainability.	Review and define new sustainability strategy
Member Recruitment	Secure letters of Intent from future industry members. Identify key individuals to work with.	Develop active outreach process through business connections, technical summits, outreach presentations, fliers and brochures. Tiered membership structure based on company size, varying benefits. What is a realistic IAB size.	Refine recruitment efforts with a greater emphasis on maximizing ability to retain key members.	Redefine recruitment and retention around a future sustainability strategy.	Develop connections to forge the best path into Sustainability.
Member Retention	Begin to define strategy to retain members through engagement in center activities including newsletters, websites and other informational tools.	Develop company interaction and benefits. Develop ideas around joint projects, testbeds, and other ERC opportunities.	Maximize ERC / company interaction and benefits. Cultivate interest in joint projects, involvement in testbeds, and other ERC opportunities. Value and mechanisms of establishing multiple points of contact in firms.	Redefine recruitment and retention around a future sustainability strategy.	Develop retained connections to forge the best path into Sustainability.
Commercialization of IP	Begin to define testbeds and cross project integration alongside a strategy for commercialization.	Develop Industry R&D needs alongside ERC needs in testbeds, Integrate industrial input from project inception, using project management tools (timelines, go/no-go points, cross project integration, etc.). Strategies for increasing sponsored research projects with industry.	Meet Industry R&D needs alongside ERC needs in testbeds, Integrate industrial input from project inception, using project management tools (timelines, go/no-go points, cross project integration, etc.). Strategies for increasing sponsored research projects with industry.	Redefine commercialization strategy around a future sustainability strategy.	Redefine commercialization strategy in light of sustainability path.
Intellectual Property	Begin to define strategy for IP management and technology transfer.	Develop processes for management and strategy, Technology Transfer and the Invention Disclosure. Start to identify key technology transfer staff for ERC IP management (invention disclosures, patent processing, IP marketing, etc.), the licensing process and what is really valuable to the membership.	Refine management and strategy, Technology Transfer and the Invention Disclosure process. Realistic chances of "big-hit" from IP generated revenue. Cultivate connections to key technology transfer staff for ERC IP management (invention disclosures, patent processing, IP marketing, etc.), the licensing process and what is really valuable to the membership.	Redefine intellectual property strategy around a future sustainability strategy.	Redefine IP strategy in light of sustainability path.
Innovation Strategy	Begin to identify key local innovation partners and infrastructure	Develop paths to entrepreneurship activities in the ERC and University, connecting to local, state, and regional economic development and incentive programs and role of investment groups such as Angels, VCs.	Cultivate entrepreneurship activities in the ERC and University, connecting to local, state, and regional economic development and incentive programs and role of investment groups such as Angels, VCs.	Redefine innovation strategy around a future sustainability strategy.	Redefine innovation strategy in light of sustainability path.
Education Programs	Begin to identify strategy to develop valuable education programs	Start student mentoring programs, short courses and workshops for industry, Certificate programs and distance learning models, Faculty and student exchange, Active promotion of industrial recruitment of graduates.	Refine student mentoring programs, short courses and workshops for industry, Certificate programs and distance learning models, Faculty and student exchange, Active promotion of industrial recruitment of graduates.	Redefine education strategy around a future sustainability strategy.	Redefine education strategy in light of sustainability path.

# Strategy: Define and Refine

Goals	Define, Develop, Refine and Optimize
Strategy and Ideation	Define, Develop, Refine and Optimize CBIIRC, Work Closely with Leadership Team
Innovation	Cultivate Innovative Culture, Entrepreneurship Course, Translational Research, Startup Companies, Innovation Partners, Angels and VCs
Education	Student Spotlights, Industry Internships, Distance Learning, Exchange, Student Mentoring, Recruitment
Member Recruitment	Industry Outreach, Summits, Conferences, LinkedIn, Connections, Site Visits
Member Retention	Newsletters, Networking, Poster Competition, Student Seminars, Technology Fair, Technology Transfer, Two-Way Confidentiality, Sponsored Research, Internships
Commercialization of IP	Integrate Industry Input, Invention Disclosures, NSF Translation Research Grants, Startup Companies
Intellectual Property	Invention Disclosure Process, Align with Offices of IPTT,



P / O / E / T / S

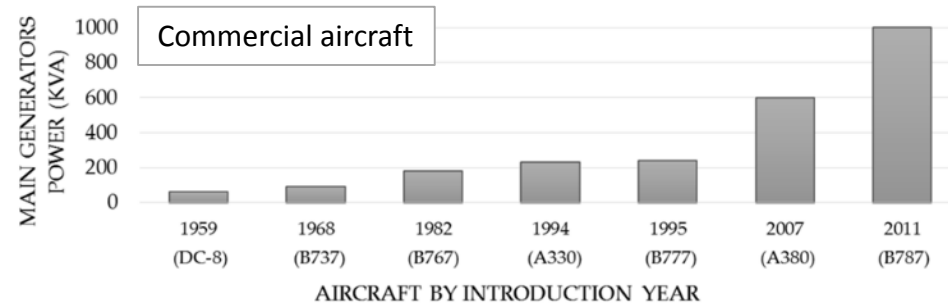
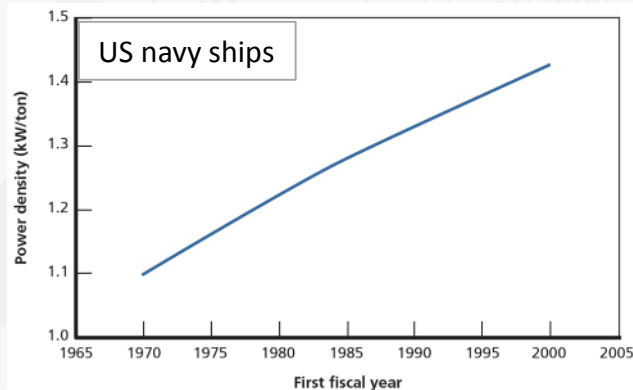
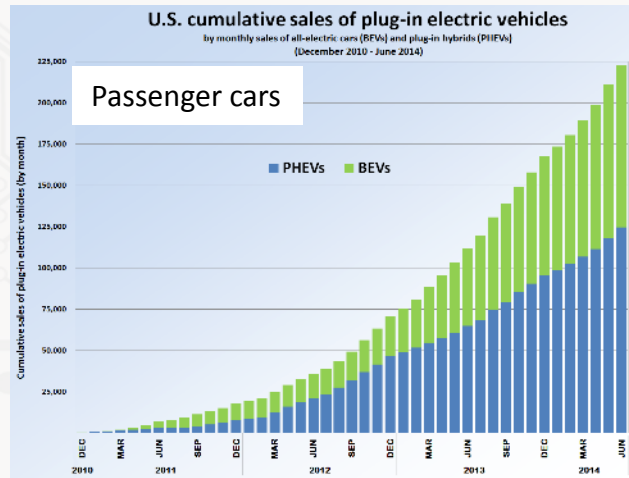
CENTER FOR POWER OPTIMIZATION OF  
ELECTRO-THERMAL SYSTEMS

## 2017 ILO Summit

K. Bender

**HOWARD UNIVERSITY | STANFORD UNIVERSITY | UNIVERSITY OF ARKANSAS  
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN** AN NSF SPONSORED CENTER

- Electrification is a mega-trend for mobile systems



- All mobility sectors affected by electrification
  - Land, sea, air
  - Mobility → power density

- Increased number of vehicles
- Increased power system per vehicle
- Increased density of power systems

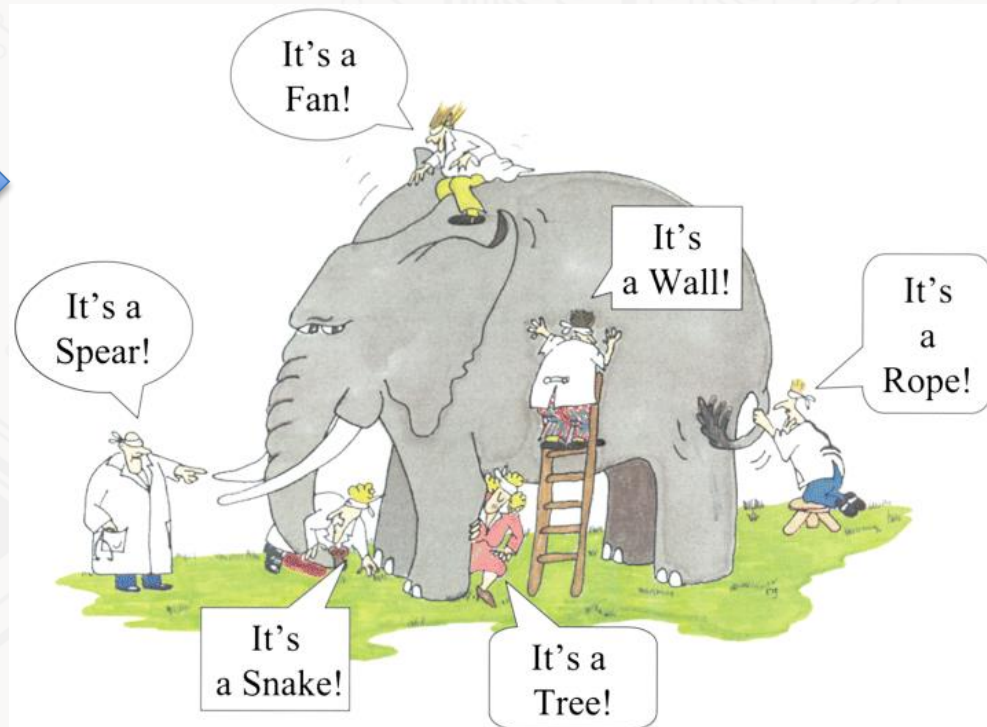
- Safety and performance concerns



- Current electrical systems are thermally limited in power density
- Far easier to put thermal energy into a confined volume than it is to take it out

- Each field approaches the problem from their own perspective and misses the whole
- Lack of a systems-level approach to power management

- **POETS brings the systems approach**







# POETS Vision

AN NSF  
SPONSORED  
CENTER



- Vision:

The POETS vision is to be the pre-eminent research and education organization driving the integrated, optimized, concurrent movement of thermal and electrical power in tightly constrained mobile environments.

- We will be able to route thermal power in confined spaces as easily as electrical power

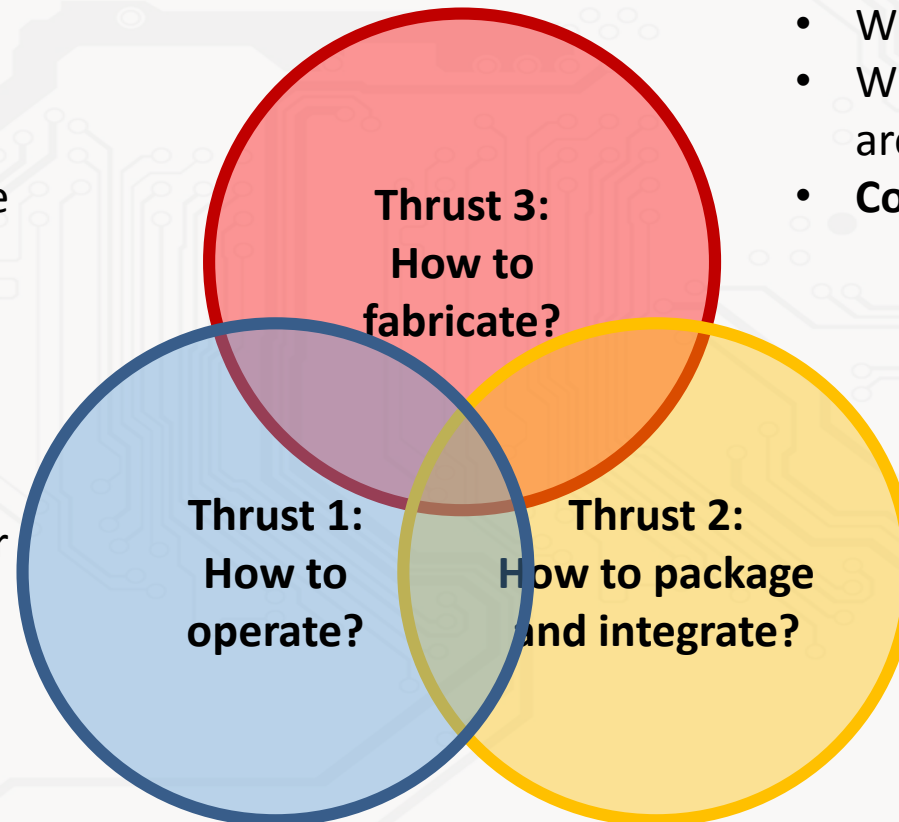
10X to 100X increase in power density over 2014 state of the art



Tight integration of Thrusts is critical

### Thrust 1

- How to off-line optimize the system for operational effectiveness?
- How to manage power flow on-line?
- **System operation**



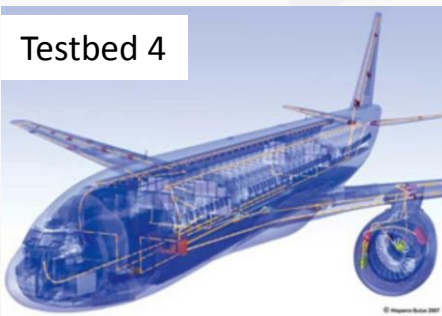
### Thrust 3

- What materials can be used?
- What fabrication techniques are feasible?
- **Component fabrication**

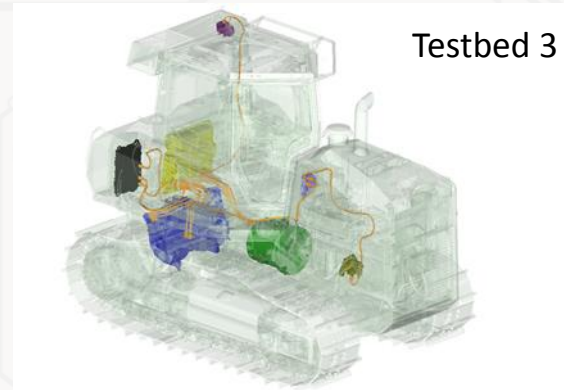
### Thrust 2

- Off-line multi-physics design with constraints
- Integration of thermal and electrical module requirements
- **Subsystem integration**

- Reflect industry market segments



Aircraft  
1MW and above



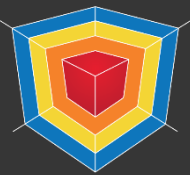
Off-highway equipment  
100-1000 kW



On-highway  
vehicles  
10-100 kW



POETS



POETS

# Industry & Government Partners

AN NSF  
SPONSORED  
CENTER

AN NSF  
SPONSORED  
CENTER



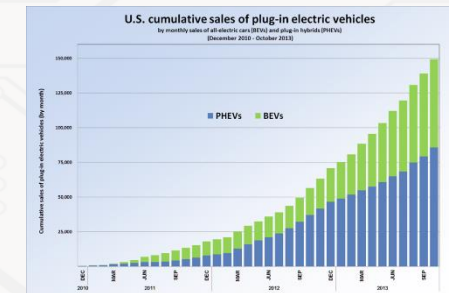
**TOYOTA**



..... and growing



- Right problem
  - Complex, multi-disciplinary, systems-level problem is appropriate for an ERC
- Right time
  - Clear need driven by global trends that will not reverse
- Right team
  - Right blend of expertise
  - Right team of institutions and industries





QESST 2017 Site Visit



# Help address the Terawatt Challenge



Richard Smalley – 1996 Nobel Prize Winner

“Find enough clean energy to raise the living standards of people around the globe”

1.5 Billion people in the dark (21%)

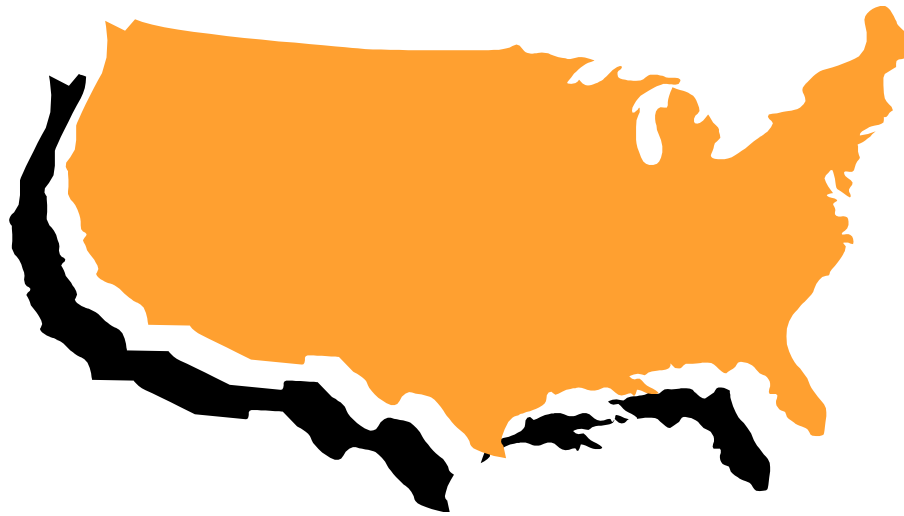
# Consortium of 8 universities



Caltech



Massachusetts  
Institute of  
Technology

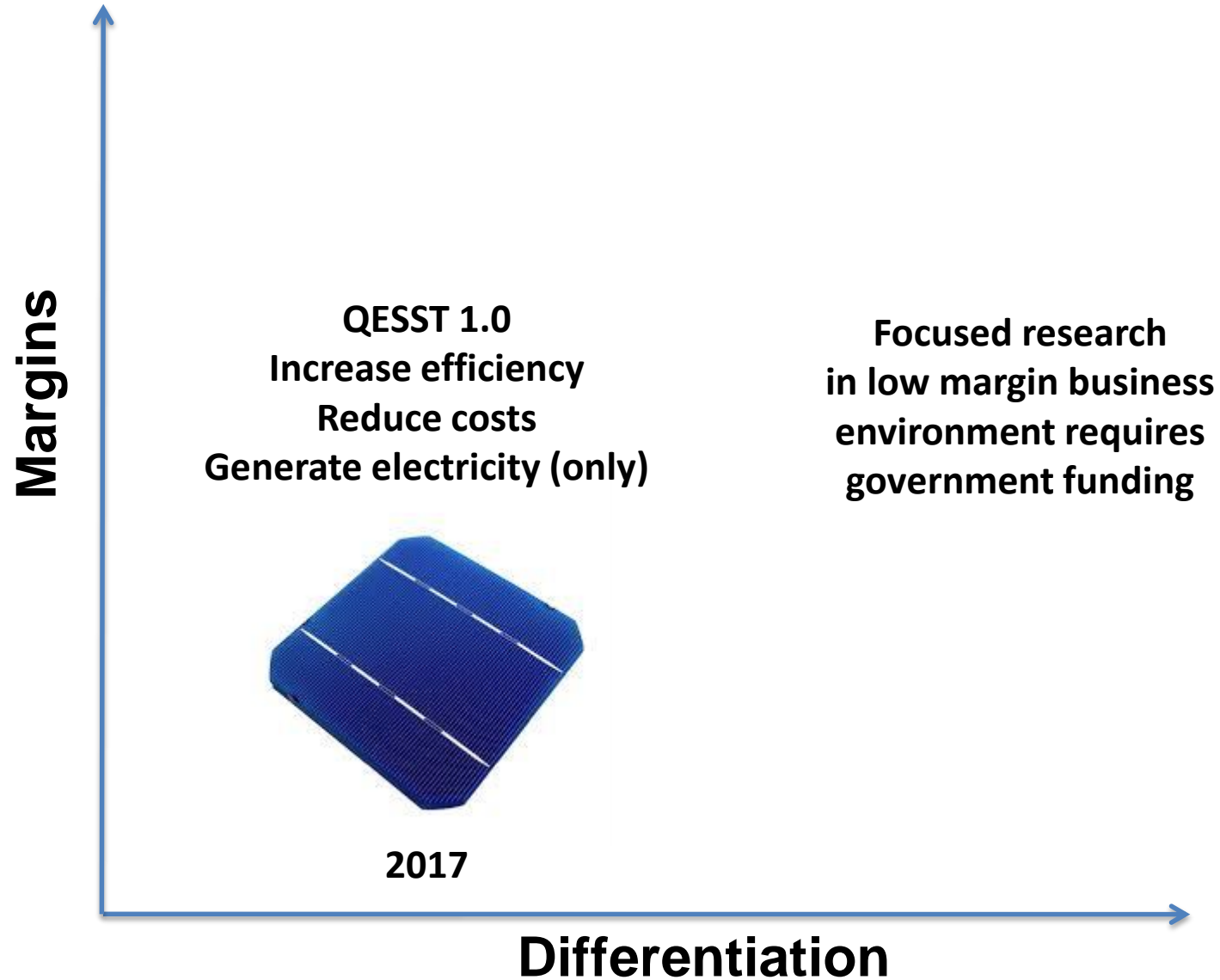




# Consortium of 8 universities and industrial partners



# QESST 1.0



# QESST 2.0



research



education



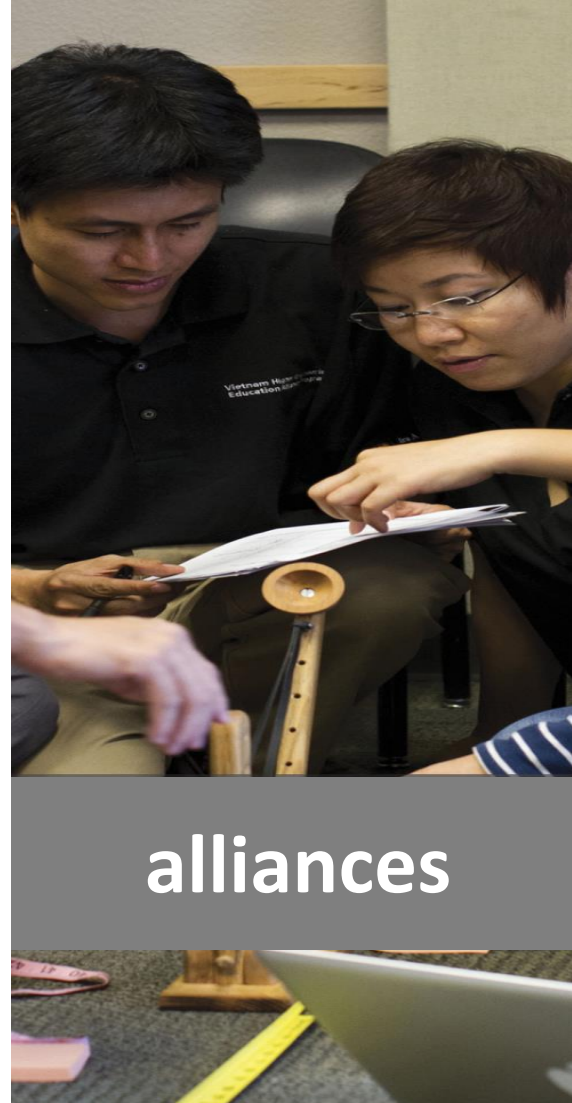
alliances



infrastructure



# QESST 2.0



alliances



# QESST Strengths – Leveraging Alliances



Leading team of researchers in photovoltaics

Unmatched facilities for hands-on training

Leading educators in photovoltaics

Worldwide network



NNCI Southwest



Imperial College  
London



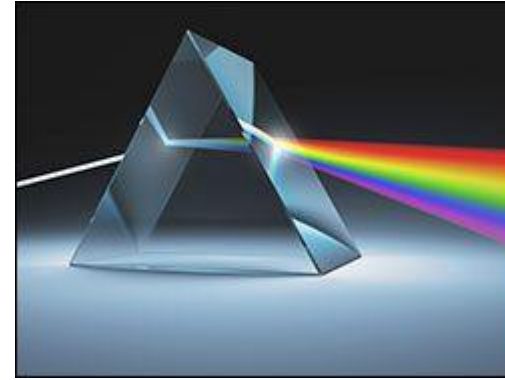
東京大学  
THE UNIVERSITY  
OF TOKYO



# QESST 2.0



# QESST Strengths – Infrastructure



The University of Arizona  
College of Optical Sciences



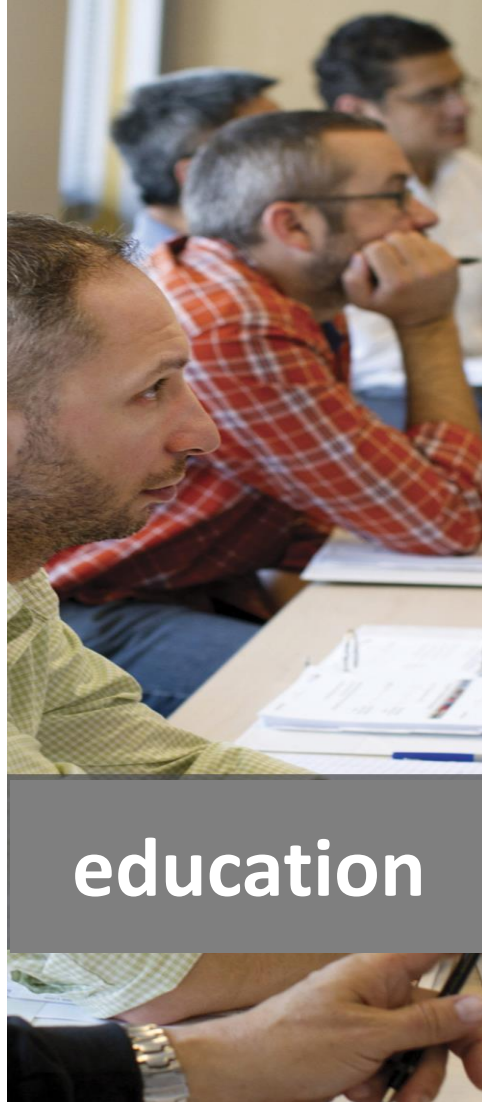
Caltech  
NNCI Southwest



Delaware

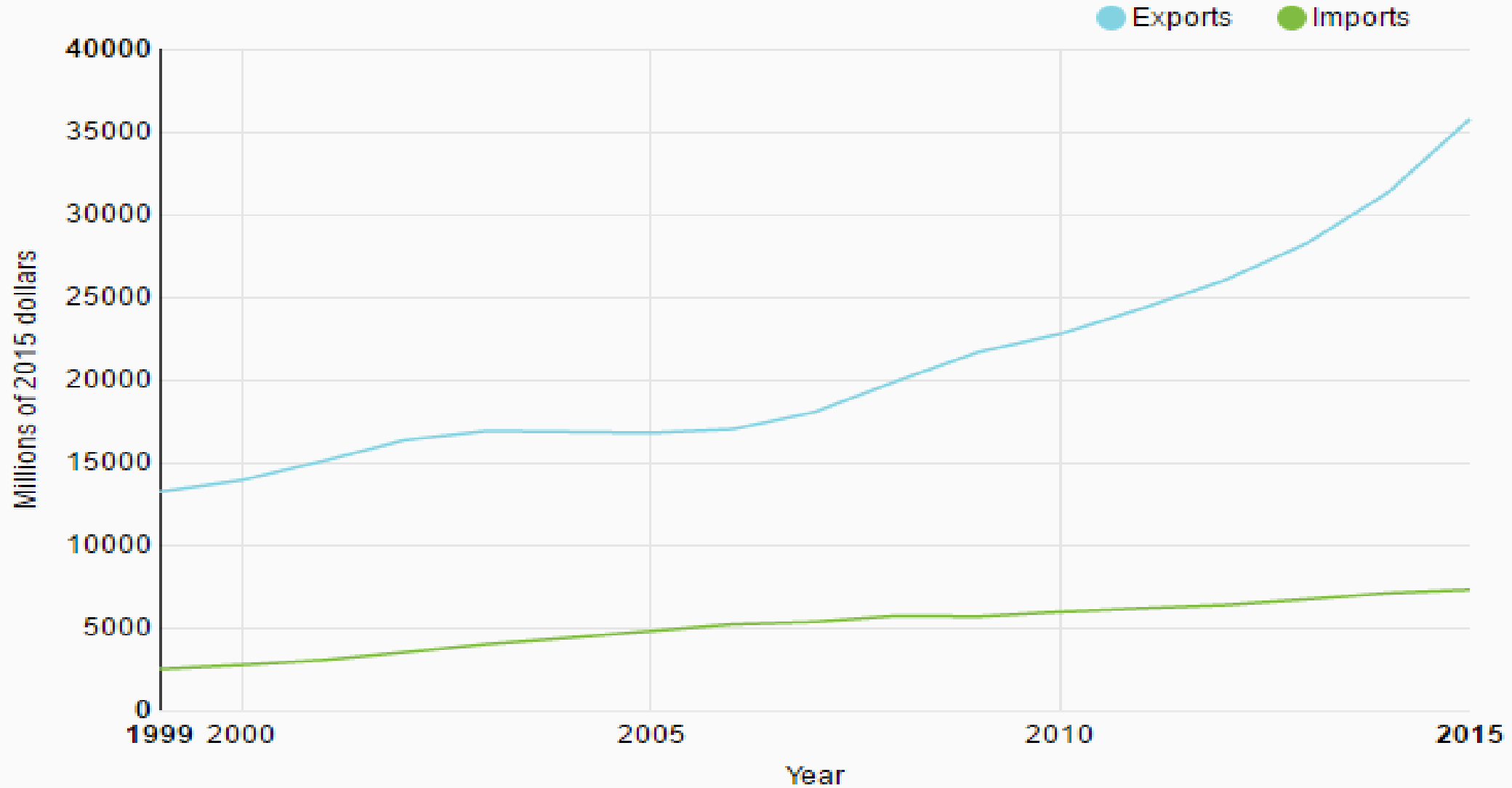


# QESST 2.0





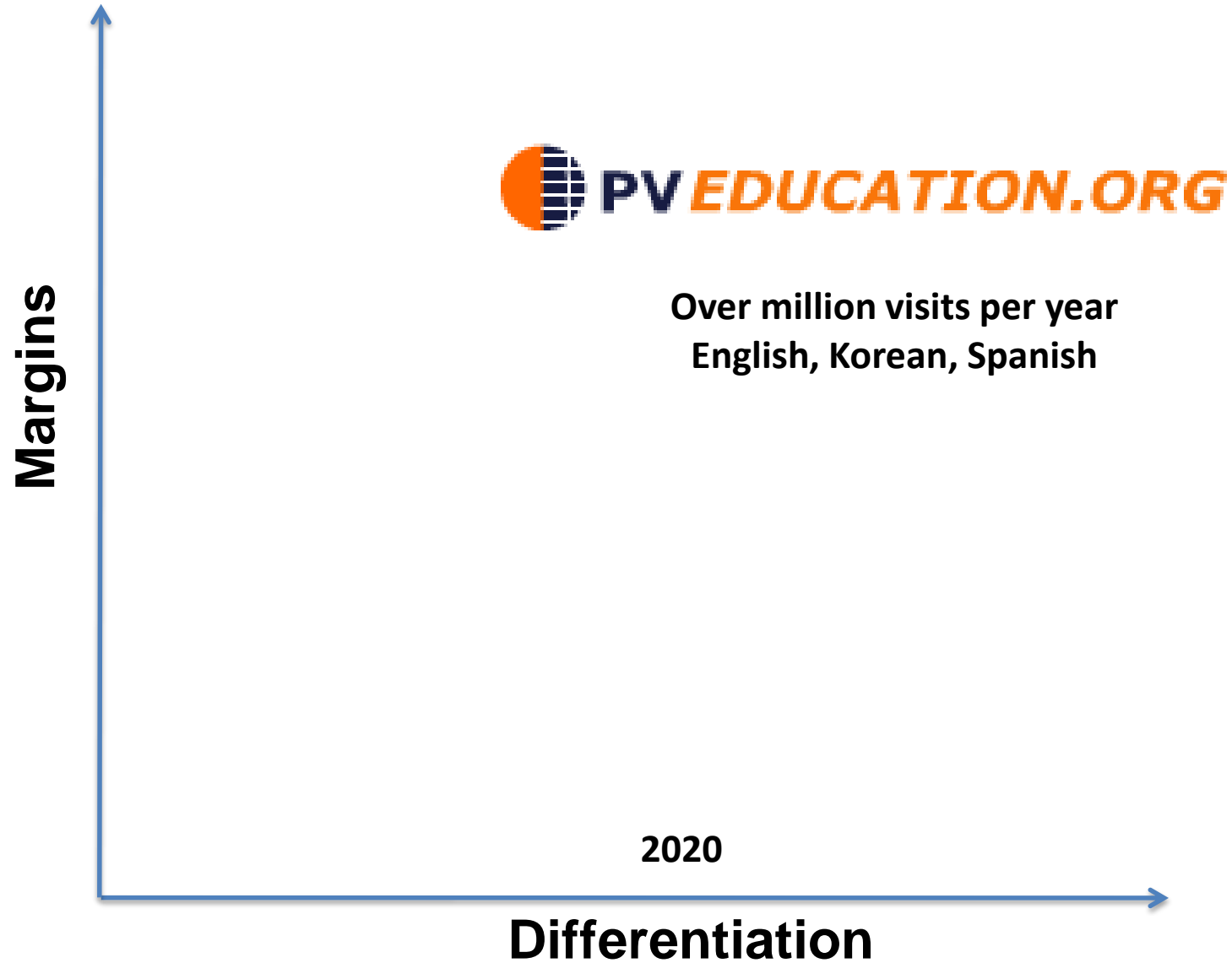
# Higher Education – 5% of US exports



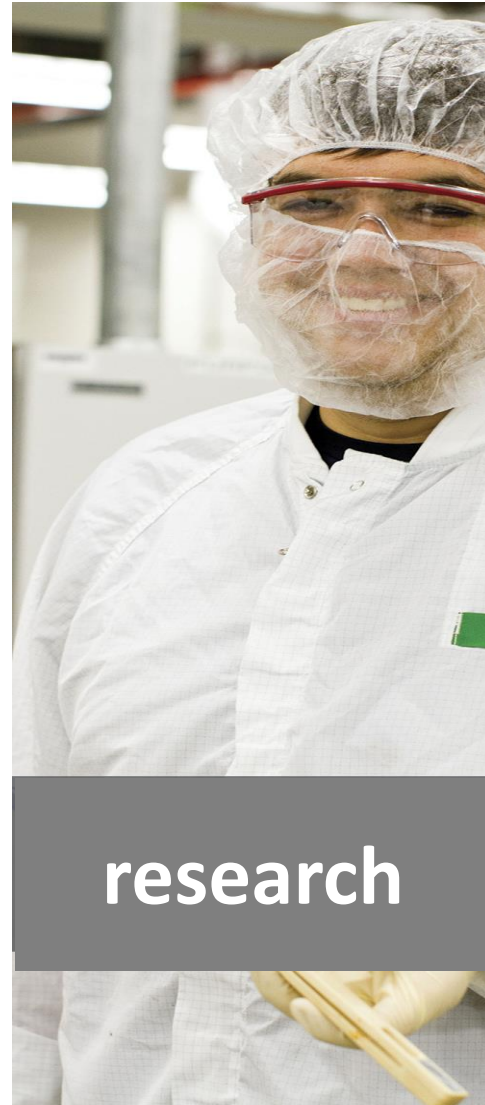
Source: [BEA.gov](http://BEA.gov); GDP deflator/Dick Startz



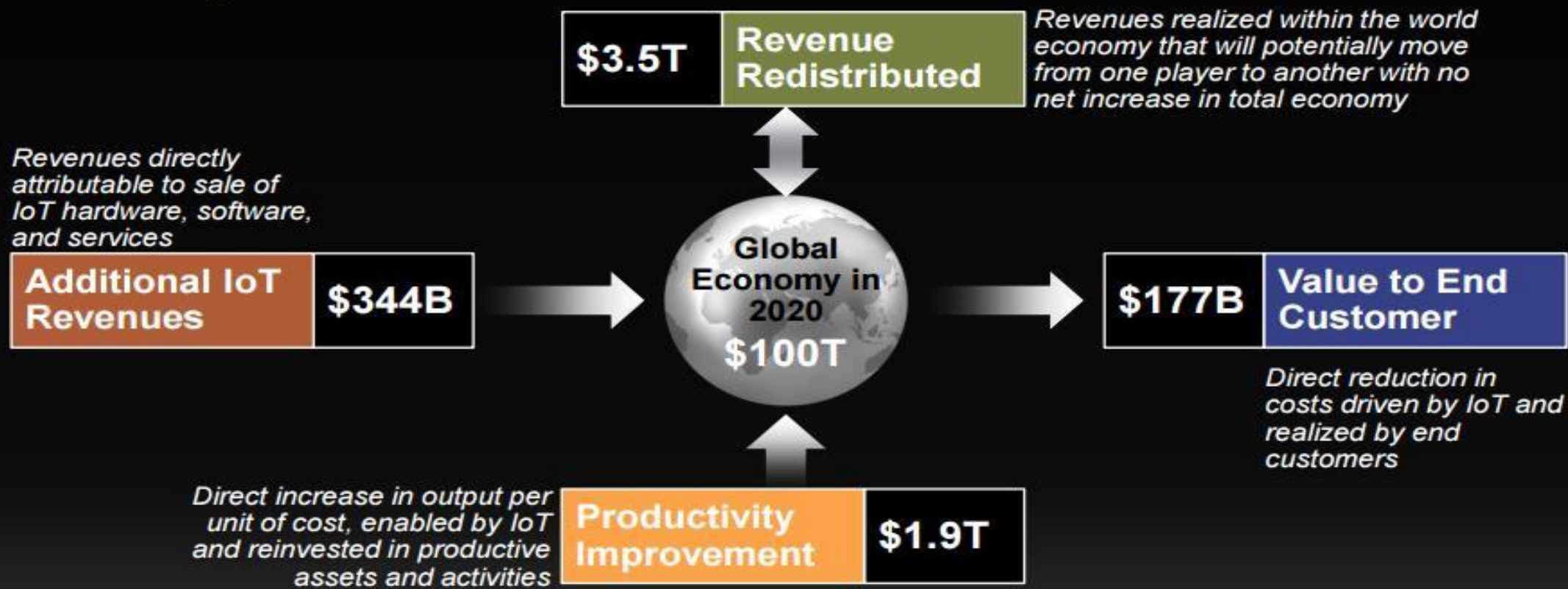
# QESST 2.0 Example - Education



# QESST 2.0



# By 2020 IoT will impact close to 6% of the global economy



IoT will be materially **disruptive** – there will be **winners** and **losers**

# QESST 2.0



**By 2020**  
**212 billion IoT devices**  
**> 25 per person**  
**All needing power**

source: IDC



# Who cares?



# Who cares? Advertisers



**Personalized advertising**



# Background



**1984**  
**Value proposition: Unwired**  
**No: data, text, camera, GPS, apps**  
**Forecast: 300,000 devices**





# Background



**1984**

**Value proposition: Unwired  
No: data, text, camera, GPS, apps**

**Forecast: 300,000 devices**



**2017**

**7,000,000,000**

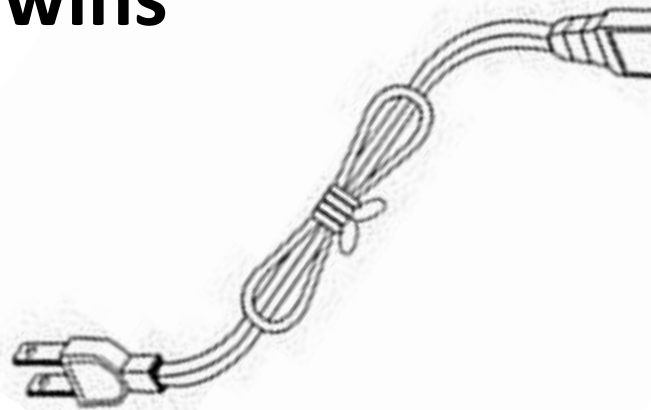


# QESST 2.0

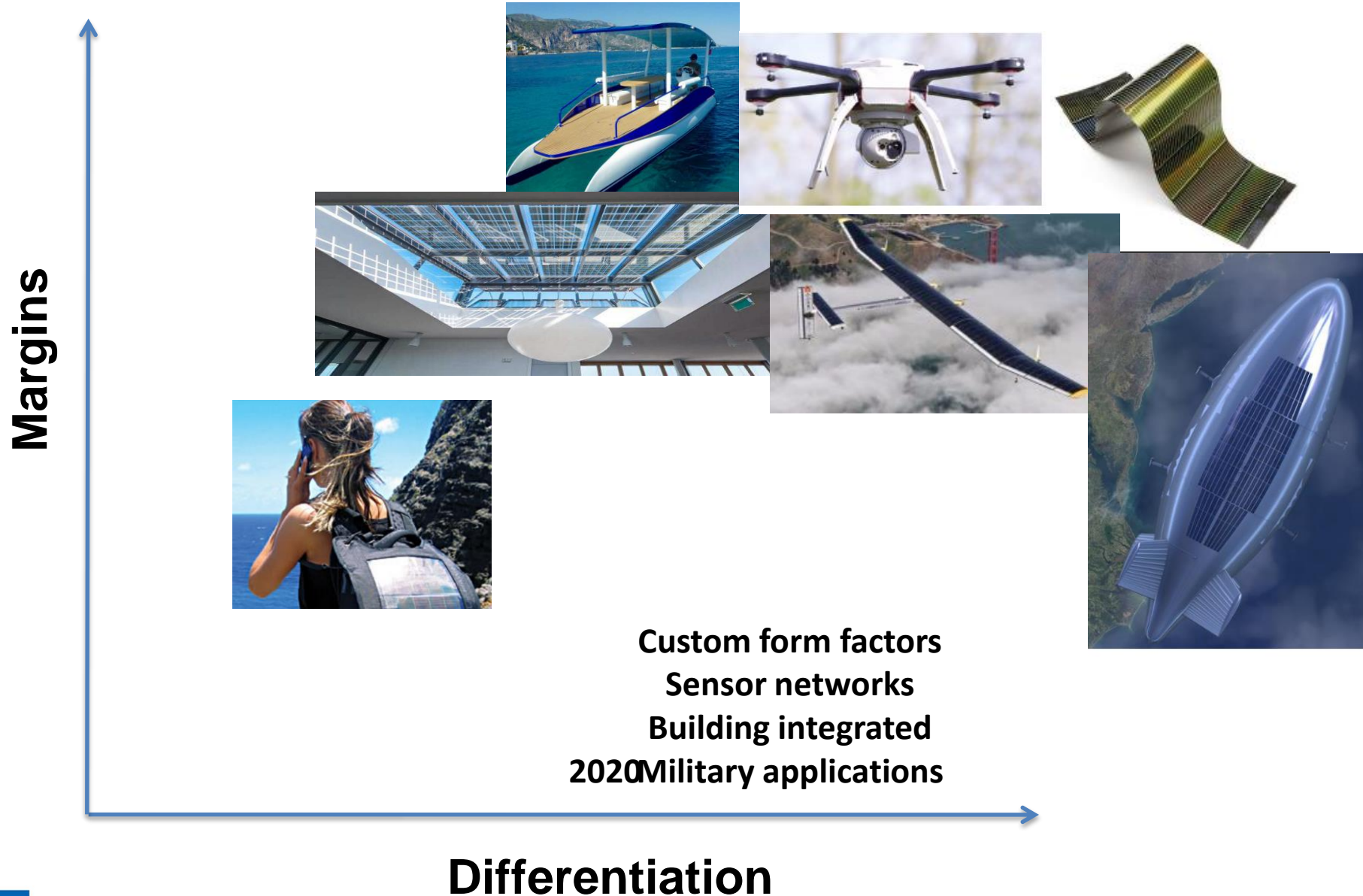
**212 billion devices in need of  
power**

**Wireless wins**

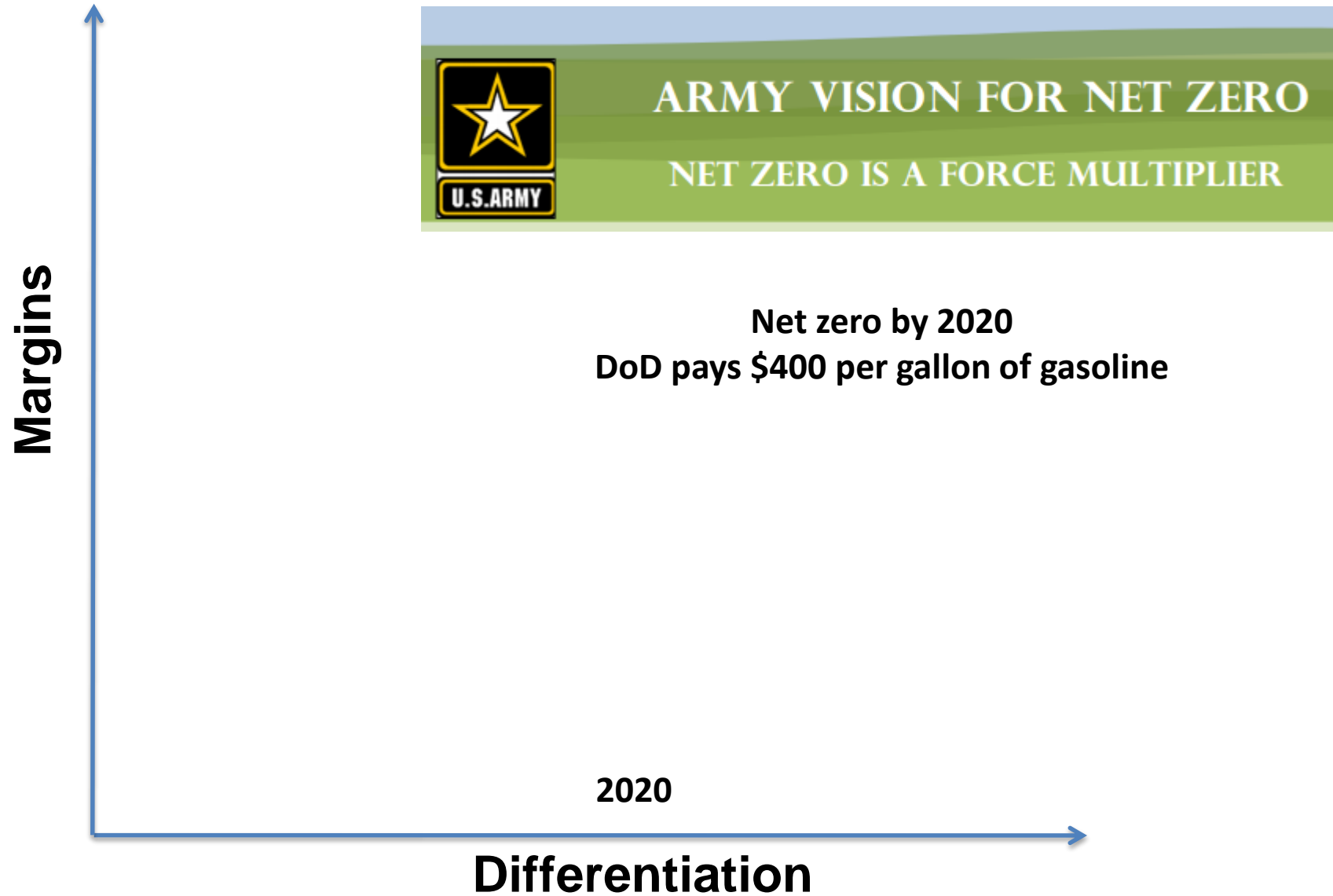
**Energy harvesting wins**



# QESST 2.0 Example- PVoT



# QESST 2.0 Example– DoD



# Next Generation Modules

High Margin Market: Light weight, Aesthetics → BIPV

Frameless



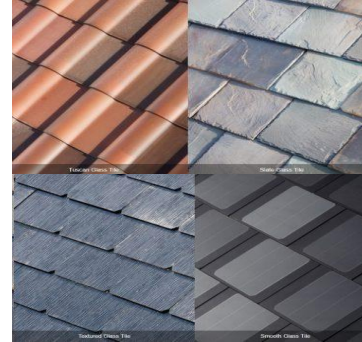
SolarWorld  
Canadian Solar  
Trina

Clear Panels



Prism Solar  
DSM Advanced Surfaces  
Topray Solar  
Sunshine Solar

Tiles



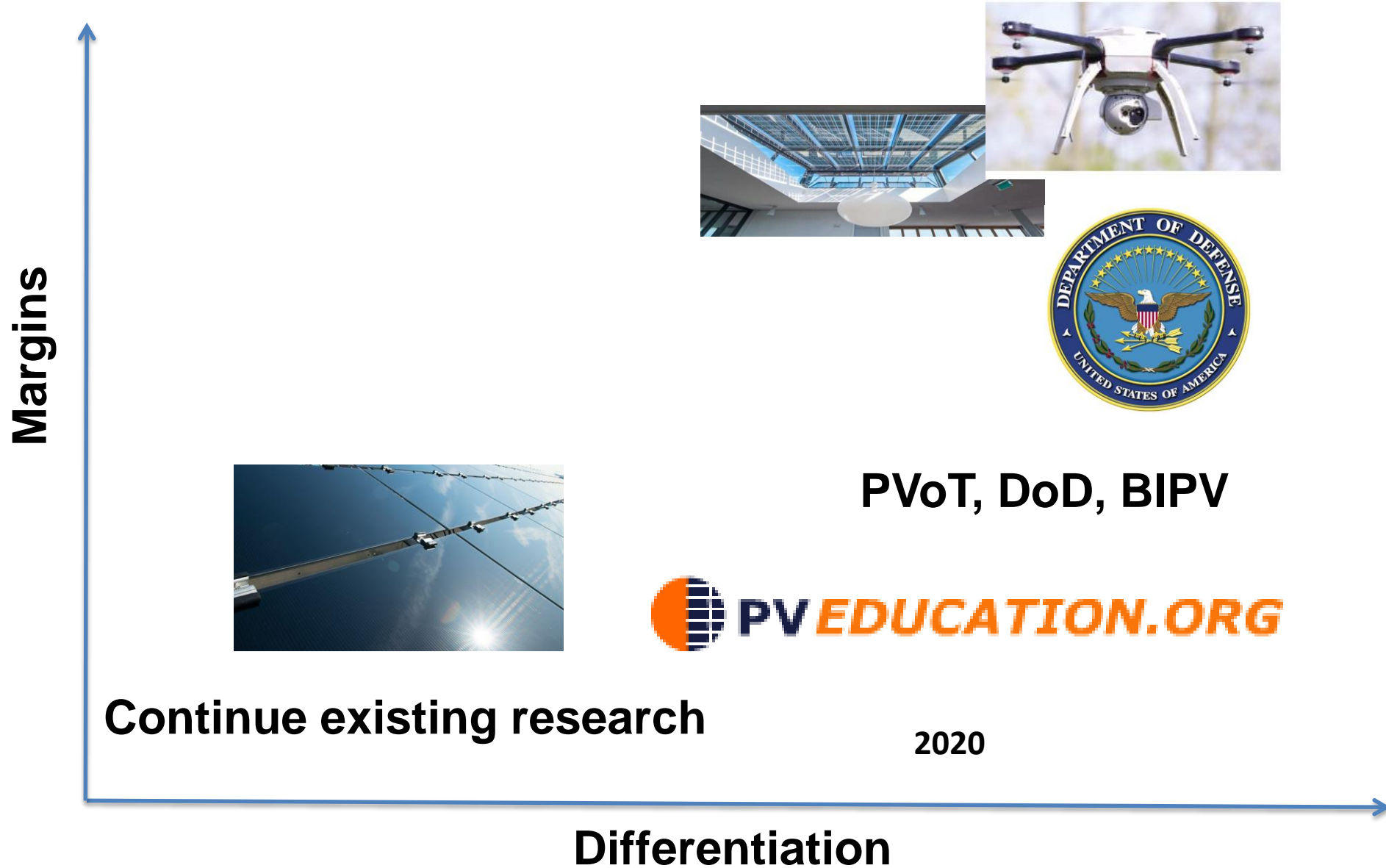
Solar City

Solar Skin



Sistine Solar

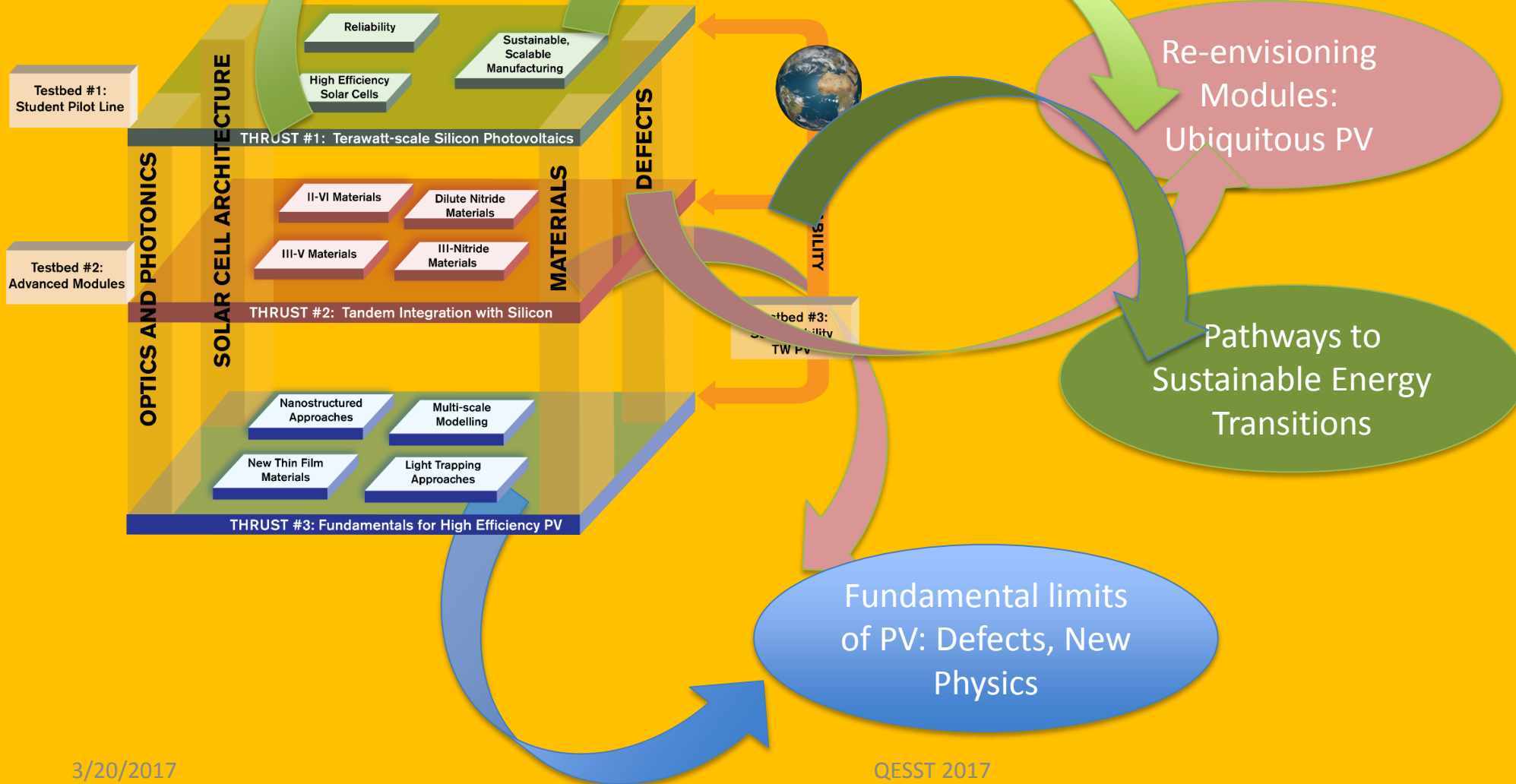
# QESST 2.0 Solution



# QESST 2.0

Workforce for the  
Energy Transition

Industry Partnership



**Thank You**





how does nature do it?

**CBBG**

Center for Bio-mediated & Bio-inspired Geotechnics



# The Role of the IAB

Nasser Hamdan



## Role of the IAB

Primarily concerned with providing direction for Center research and education programs.

- Provide perspective into the **critical needs** of industry and practitioners.

Provide input on-

- Research priorities
- Technology demonstrations
- Technology-to-market business planning.

# Role of the IAB

Responsibilities include:

Annual and midyear review of current projects (tech., pract.)

Guidance regarding these projects (crit. needs?)

- Informs our internal reviews

Review & input on new, annual projects

- which ones should be awarded?

Annual SWOT

## Role of the IAB . . . Getting into the weeds

Role of the IAB is fairly clear, **but not so simple in practice.**

To understand this, check the composition of the IAB (**17 Industry Partners**) and highly diverse nature of the Center:

- *Geotech and contractors* → ground improvement
- *Geoenvironmental* → soil and water remediation
- *Consultants* → ground improvement, remediation, exotic/complex projects
- *Owners/operators* → landfill, mining, oil & gas, slag/metals, utilities
- *Agencies* → State DOT, State Environmental

# Industry Partners



Industry partners have very different types/ranges of expertise

Industry-specific concerns favor certain research areas/projects

Diverse nature of CBBG covers wide range of projects and research

### **25 projects covering 6 research areas!**

1. Lifecycle analysis
2. Bio-cementation/solidification
3. Fluid flow/Transport
4. Microbial processes
5. Environmental/Landfills
6. Infrastructure



- Enzyme induced carbonate precipitation
- Liquefaction mitigation via microbial denitr.
- Electro-kinetics
- Annelid Inspired Geo-probe
- Microbial processes in extreme env.
- Tree/plant root inspired foundations

Breadth of technical content is outside capabilities of any single

## Role of the IAB . . . A practical approach

Only 4 projects per industry partner → they choose projects

- Typically follow their “favorites” anyway
- Provide deeper technical and value input

“Orphan” and low-count projects are politely “assigned”

- Relevant expertise is a limiting factor
- Encouraged to comment on potential value to (other?) industry(s)

## Role of the IAB . . . A practical approach

Projects closest to field testing/application receive value input

- Not necessarily same as the “technical” favorites
- Input typically involves costs and lifecycle considerations
  - follow-ups!
- A great tool to solicit direct industry support!

Ultimately, you must know your industry partners . . .

**strengths, interests and capabilities** (time, staff, etc.)



# Role of the IAB . . . the Annual SWOT

A similar logic applies to gather details for SWOT

But, SWOT requires **holistic approach**

- Individual, sub-group technical interests become secondary
- Intra-industry competition and secrecy is not a concern
- Cross-industry perspective in the context of the Center mission
  - Develop innovative technologies to serve civil engineering industry
  - Educate & train future engineers in the field of Biogeotechnics

This is where IAB group work happens over partner interests

## Role of the IAB . . . Education

This is where IAB group work is seen again

Open, positive discussions about multidisciplinary education program and student activities

Plenty willing to speak with students

- Individually, sub-groups/specialty areas and via webinar

General perception that students are well-prepared and ready to hire

- Several hires and internships by industry partners

***Thank You***

**Questions?**