

BREAKOUT Instructions Sheet:

Day 2: Program Pitch (Walk in the shoes of an ARPA-E PD)

- As a group formulate a program level pitch that answers all of the Heilmeyer Criteria, leveraging the content presented on Day 1.
- Nominate one group member to prepare the pitch.
- Convey all the information necessary for the moderator to present a reasonable pitch at the readout session
 - ▶ Justify your program metrics in the context of energy saving.
 - ▶ Build an exemplary system that can potentially meet the program metrics.



Breakout Group #2

First Name	Last Name	Company/Organization
Dane	Boysen	ARPA-E Moderator
Amul	Tevar	ARPA-E
Ashwin	Salvani	ARPA-E
Christine	Cole	Clemson
Allen	Curran	Thermoanalytics, Inc.
Steve	Fossey	Natick Soldier RD&E Center
Lei	He	UCLA
George	Hernandez	BTO/PNNL
Bing	Hu	University of Maryland
Byron	Shaw	Gentherm
Girish	Srinivas	TDA Research, Inc.
Dan	Steingart	Princeton University
Diane	Warren	VFC
Xiaojiang	Xu	US Army Research Institute of Environmental Medicine
Ronggui	Yang	University of Colorado



CHANGING WHAT'S POSSIBLE

HOT PANTS

Honing Optimal Technologies for Personal Attire Novel Thermal Solutions

November 20, 2013

Who Cares?

- ▶ Consumers:
 - people want comfort (can 20% be reached?)
 - chic to be energy efficient
- ▶ Utility Payer:
 - +/-4 F ~ 10% building energy
- ▶ Government:
 - 50% reduction = removing all cars from road
 - exist building technology has had little adoption in 20 years

Solution:

- metric must have correlate comfort with energy savings
- personal comfort management could allow potential penetration the 20% uncomfortable people market

What are the Challenges?

Market/Adoption:

- How can we keep the existing 80% comfortable people while extending range building temperature range?
- Energy efficiency and comfort are typically inversely correlated
- Focus on energy efficiency with thermal comfort
- End user is disconnected from the cost of energy
- Data informatics – user informed decisions
- What is the first market?

What are the Challenges?

Technical Challenges:

- Data informatics – relationships between comfort and energy use
- Defining the control envelope/energy consumption relationship
- Understand critical impact areas on the body
- Active solutions: power main issue, cost, comfort, overall efficiency, weight, convenience, water compatible, washable, cycle life
- Passive solutions: 2% change in thermal resistance – needs 20% change in thermal resistance for 2 degrees, humidity and thermal transport, uncomfortable, heavy
- Privacy & rejection of new approach

What is the SOA? What is new?

State of the Art

- Design – strategic location of materials
- GoreTex, wicking fabrics, textural fabrics
- PC shirts (lame only 1 hr)
- Nanotech (anti microbial, stain coatings)

What is new?

- Conformal batteries
- Emissivity changing fabrics and coatings
- Alliesthesia
- High thermal conductivity flexible materials
- Big data: every person has temp, GPS, humidity (cell phone)

Metrics

metric must have correlate comfort with energy savings

- Safety
- Envelope
- Performance
 - Energy benefit
 - Life
 - Comfort
 - Impact benefit
 - Cost (to who?)
 - Flexibility (same shirt, different day?)

Program Categories

- ▶ Sensing and modeling, predictive behavior (establishing baseline)
 - Physiological approaches (allesthesia)
 - Fully integrated systems (innovation is on integration and control)
- ▶ Passive solutions
- ▶ Active solutions
- ▶ On-person vs. distributed
 - Furniture
 - Radiant Surfaces (Curtains/Carpet/Walls/Ceilings)

Adapted Heilmeier Criteria for Your PTM Program Pitch:

Slide 1 of 4

- ▶ What are the challenges associated with improving building heating and cooling?
- ▶ What are limitations of current personal thermal management (PTM) that prevent its wide spread use to supplement building control?

Adapted Heilmeier Criteria for Your PTM Program Pitch:

Slide 2 of 4

- ▶ What is the structure of your PTM program?
- ▶ What technology areas would you fund? For each area, what is the deliverable?
 - 1. tool kit – simulation, verification – what does it take to make someone comfortable
 - 2. technology
 - passive/active
 - wearable/not wearable
- ▶ What are the metrics for each deliverable?
- ▶ How do these metrics correlate with building energy saving?
 - if successful, what is the impact – quantify

Adapted Heilmeier Criteria for Your PTM Program Pitch:

Slide 3 of 4

- ▶ What new innovations provide the framework for you to believe that your PTM program will be successful?
- ▶ What are the technical and programmatic risks? What breakthroughs are we looking for?
- ▶ What is the expected composition of a project team?

Adapted Heilmeier Criteria for Your PTM Program Pitch:

Slide 4 of 4

- ▶ If your PTM program is successful, who will care? Who needs to care in order to reduce building energy consumption?
- ▶ How mature can we develop PTM technologies with 3 years of ARPA-e investment? How long and how much will it take to further develop the technology to be ready for commercialization? What is your expected technology transition pathway to market? What are potential first/adjacent markets?