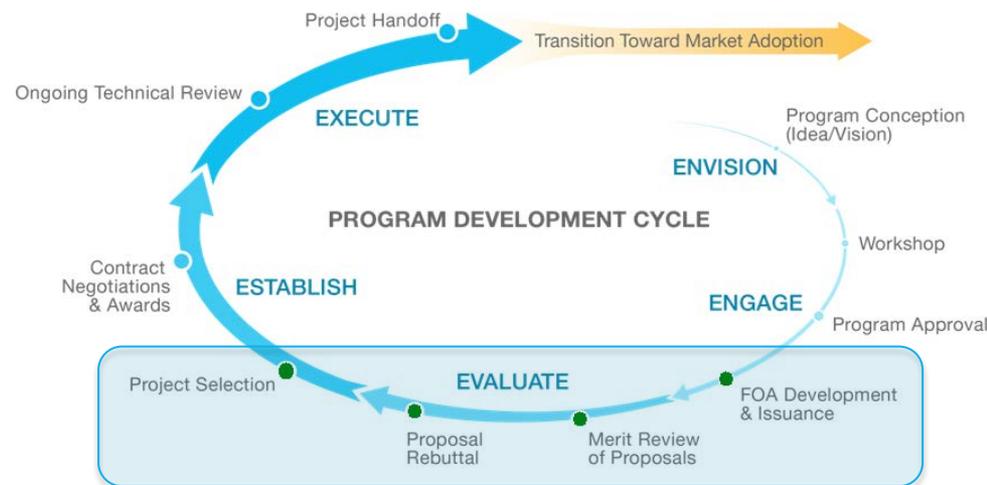# BREAKOUT Instructions Sheet:

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 Heilmeier 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.

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Breakout Group #3

First Name	Last Name	Company/Organization
Jonathan	**Burbaum**	**ARPA-E Moderator**
Russel	**Ross**	**Booz Allen Hamilton**
Vince	Baranauskas	NanoSonic
Gang	Chen	MIT
Bruce	Conger	Jacobs Engineering
Jim	Freihaut	PSU - DOE Energy Innovation Hub
Mike	Gibson	MIT
Meagan	Gleason	Under Armour
Warren	Jasper	NCSU
Hilary	Lackritz	SRI International
Pete	Lynn	Otherlab
QiBing	Pei	UCLA
Michelle	Povinelli	University of Southern California
Behnam	Purdeyhimi	North Carolina State University

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Buildings Enhanced with Transformational Technologies for Energy Redistribution

Challenges & Limitations

‣ Challenges:

  – Lack of spatially resolved metering, standards in building control systems (HVAC, etc.) no end-use data

  – Building manager incentives not aligned adequately with energy savings

  – Existing PTM strategies (e.g., clothes) are under-utilized

‣ Limitations:

  – Inefficient/ineffective local heating/cooling

  – If clothing is part of solution, then must address fashion/clothing supply chain

  – Cultural norms: People don't consider performance in PTM choices

  – Building management more than satisfying personal comfort

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Program Structure & Metrics

‣ Structure:

– Phase 1: Materials, Electronics, Physiology, in-house/component Testing

– Phase 2: Fashion/psychology/product design, System integration, IVV Testing (ensemble)

– Phase 3: Production/commercialization

‣ Technology Areas:

– Wearable Devices (clothing, joule heaters, fans, detectors)?

– Local, stationary devices (heating cubicles, seats, beds, foot warmers)?

– Systems-level solutions?

‣ Metrics:

– Marketing approach? Value of sustainability?

– Cost/benefit: $xx/degree of extension of neutral zone? Relation to productivity?

– Years-to-payback/ROI?

– For systems: time-to-response metric?

– Is there an easily measurable comfort metric (neutral zone)? [+- 4 degrees F extension of neutral zone (saving ~1 quad of energy)]

– Net energy saved?

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Innovations, Risks, Teaming

‣ Recent innovations:
  – Smart materials
  – Wireless, systems-level communication, distributed/personal sensor networks
  – Wireless power (enables active PTM vs. passive PTM)

‣ Risks & Breakthroughs
  – Adoption, adoption, adoption; Major risk is measurability of outcome
  – Cooling: conductive cooling is thermodynamically tough (natural evaporative cooling may circumvent)
  – Breakthrough: Proper, easy metrics of comfort

‣ What is the expected composition of a project team?
  – Materials
  – Electronics
  – Physiology
  – + Fashion/psychology/product design
  – + System integration
  – + IVV Testing (ensemble)
  – ++ Production/commercialization

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Impact of ARPA-E Program

‣ Who will care, and who needs to care in order to reduce building energy consumption?

– Individuals more than building managers care, building managers need to care

– Need buy-in from construction industry/architects

‣ Program maturity: Through component design and integration (Phase 1 and 2 on previous)

‣ Commercialization/Transition to Market

– Timelines depend on the extent of integration with building systems, fashion

– Stand-alone technologies = shorter timelines. How do they end up reducing energy?

– Can any product give a net-positive ROI in terms of energy?

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