Designing a solar powered jacket: Interdisciplinary research and design through the functional, expressive, and aesthetic (FEA) consumer needs model

Kathryn Kaalberg

Contributor: Shannon Roth

Advisors: Dr. Ellen McKinney & Dr. Eulanda A. Sanders

### Introduction

Wearable technology and product sustainability in the apparel industry is an increased focus of consumers. Because few apparel products beyond accessories exist in the marketplace today, research is needed on the functionality of solar panels and their integration into apparel.

A major problem of wearable electronics currently on the market is the reliance on conventional power supplies (i.e. batteries) that are typically heavy, made from toxic sources, and have a short lifetime. To save resources, solar energy can be harnessed.

Flexible solar panels offer a sustainable, lightweight source of energy, but consumer attitudes towards solar powered clothing are greatly affected by the product's functional, expressive, and aesthetic (FEA) qualities (Hwang, Chung, & Sanders, 2016; Lamb & Kallal, 1992).

### Methods and Procedures

The apparel design framework and FEA model by Lamb and Kallal (1992) guided the process of designing a solar powered jacket:

- **Problem Identification:**
  - Identified design problems through focus groups & sample garment analysis

- **Preliminary Ideas:**
  - Sketching, research and Q&A brainstorming sessions

- **Design Refinement:**
  - Modification of ideas compared to design requirements and number of solar panels needed for specified wattage

- **Prototype Development:**
  - Jacket samples created through Optitex to determine appropriate material selection and construction

- **Evaluation:**
  - Samples sewn and evaluated according to established functional, expressive, and aesthetic design criteria

- **Implementation:**
  - Revision and execution of jacket design

### Purpose of Study

The purpose of this research is to integrate solar panels into apparel in an expressive and aesthetic manner for the consumer market.

### Results

- **Identified target consumer:**
  - Male and female
  - Recreational hikers

- **The most important design criteria were identified as:**
  - Functional
  - Minimum energy output
  - Expressive
  - Visual adaptability

- **Balancing the two was challenging:**
  - Wearer safety and garment function vs appropriate electrical components
  - Findings may be useful for future wearable solar products.

### References
