<u>MECS next stage ISEC development. July 26, 2020</u>

<u>Proposed General Plan:</u>

We have developed Insulated Solar Electric Cooking (ISEC) to the point that we have a product able to be mass produced on location. Nevertheless, we are still ironing out some finer points, and the technology needs to be adapted to local needs, climate, resources, and preferences. Thus, we need to disseminate the technology to partners in the field for local production. We hope to support production (technologically and financially), study adoption in each location, and share knowledge with a global learning community.

This money supports continued research at Cal Poly and includes startup funds to help collaborators in the field with both expertise and initial hardware needs. We are developing a global learning community through online resources (presently hosted at http://sharedcurriculum.peteschwartz.net/solar-electric-cooking/) and virtual consultants, which may include translators and technical experts. In addition to this technical support, each partner will be provided with financial support for startup costs including hardware purchases and hiring employees dedicated to ISEC construction and deployment.

We will continue to collaborate with Nextleaf as a partner in adoption studies. Additionally, Professor Nichole Hugo of Eastern Illinois University (Hospitality and Tourism, Undergraduate Internship Coordinator, Graduate Coordinator of Sustainability) is supervising the dissemination team responsible for collaborator vetting, support, and adoption study.

<u>Costs for Research, Development, Dissemination and Adoption Study</u>:

For the next 12 months, we request $5000 for Martin's expert consulting fee, $10,000 for stipends to students studying project management (including collaborator vetting and support, implementation, and adoption study), $2000 for materials, and $5,000 for virtual collaborator support. Lastly, our costs include $35,000 to support development of collaborator manufacture capability. The total spending is $57,000. Only the $5,000 for virtual collaborator support is subject to overhead, so the total cost to MECS is $59,015.

<u>Technical Deliverables</u>:

1) At Cal Poly, ISEC models with a USB charging port, with and without thermal storage capacity, will be optimized for cost, performance, and user convenience.

2) Collaborators will gain ISEC manufacturing capacity uniquely applying our design to their unique access to resources as well as unique local needs and preferences.

3) At the end of one year, we will have documented the adoption of at least 200 ISECs (100 with PCTS) with our collaborators.

<u>Vetting and Support of Collaborators in the Field</u>

Collaborators in the field will be vetted and financially supported for deliverables in a stepwise fashion. The amount and criteria for funding will depend on each collaborator's constraints, resources, and value of contribution. We offer the following as an example:

<u>Stage 1:</u> $1000 to establish construction capacity with deliverable of 8 working ISECs to be implemented in homes (average cost of $125 per ISEC, including cost of solar panels). In order to receive this funding, the partner will satisfy the following criteria as judged by the dissemination team:

- Technical expertise necessary to construct ISECs
- Experience in dissemination and familiarity with a target community
- Presentation of a plan to establish a business

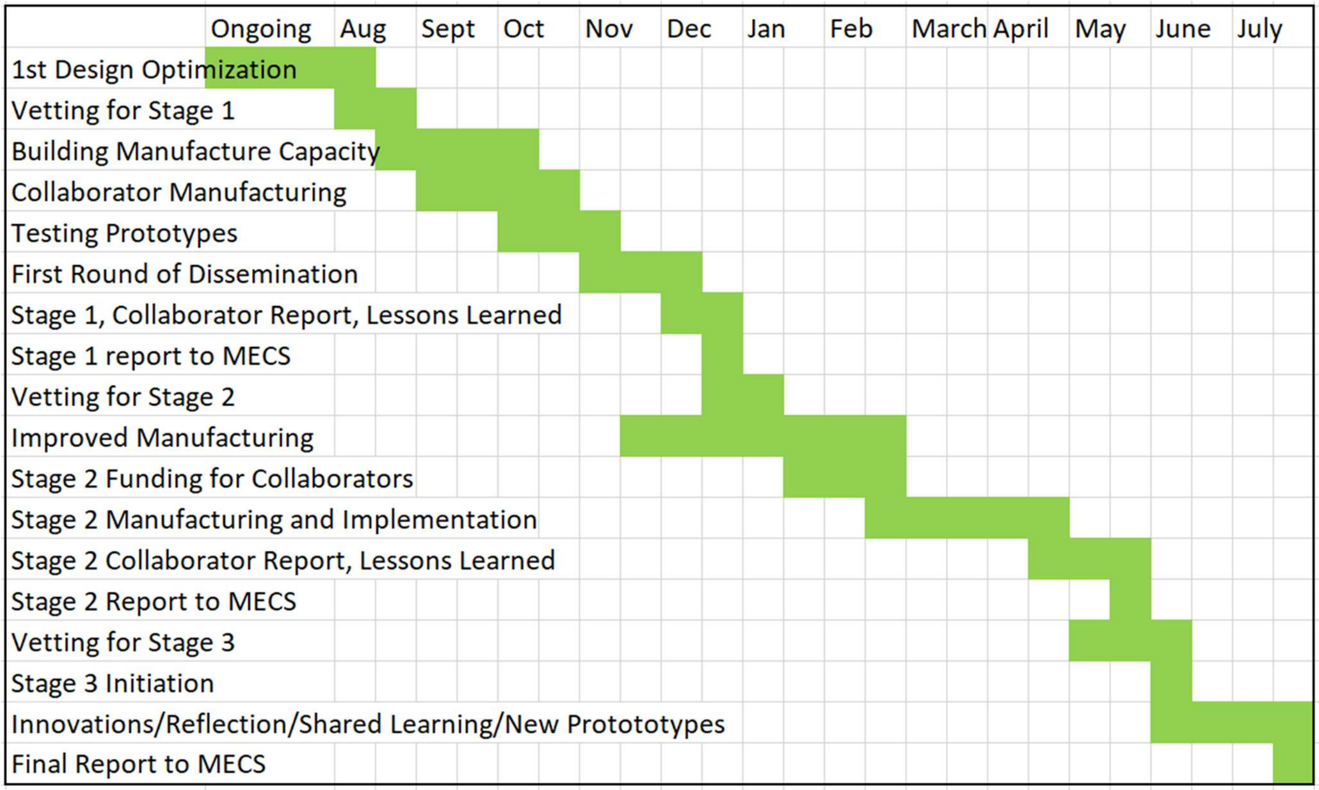
Stage 2: $4000 to scale up construction and dissemination with deliverable of 80 ISECs to be implemented in homes (average cost of $50 per ISEC, including cost of solar panels). This will require the collaborator to receive partial income from sales or some other source. In order to receive this funding, the collaborator will satisfy the following criteria:
- Has established construction capacity and successfully deployed 8 working ISECs in homes (Stage 1)
- Has presented a plan toward financial sustainability. For example, they propose a means to make income from sales (or some other means) to profitably produce these 80 ISECs.

Stage 3: Further funding. The dissemination team will consider proposals from collaborators that have successfully completed Stage 2. Examples may include a smaller subsidy for further production and opportunities to start additional manufacture/dissemination centers.

Value Add: MECS payment of $59,015 leverages considerable university resources:

- Two professors (Schwartz and Hugo), supported by salaries to teach and supervise technology development and deployment with students.
- Frost Stipends. This summer, three students each received $3,500 for 8 weeks of full-time research and Schwartz received $4,000 to advise them. Additionally, another student volunteered full time for the research experience.
- Besides working this summer as an expert consultant developing ISEC technology, Martin Osei will subsequently continue research in the coming year for his master's thesis.
- Professor Hugo will implement ISEC cooking into an Eastern Illinois University food laboratory to study ISEC effectiveness in cooking appropriate foods.
- Part of the contribution from Olivia, Grace and two other students is their group senior project, an academic requirement.
- Pete Schwartz advises about 3 senior projects each year dedicated to ISEC development as part of being a professor.
- Group Senior Projects in Engineering: Schwartz provides design challenges for teams of Mechanical Engineering students for their year-long senior project design, production, analysis – typically two projects every year. One example is the first ISEC with phase change thermal storage: https://digitalcommons.calpoly.edu/mesp/494/
- Appropriate technology classes. Schwartz facilitates a class of about 40 students in the fall (http://appropriatetechnology.peteschwartz.net/appropriate-technology-development-fall-2019/) and the spring (https://canvas.calpoly.edu/courses/22904). These are group-project focused classes where an interdisciplinary team focuses on providing a service to a community. Many of these groups learn about, and improve the technology and dissemination of ISEC. Examples include ISEC with collaboration in India (https://gcastr09.wixsite.com/calpolyisec) and ISEC in Nepal (https://univ492group1.wixsite.com/website).
- Information Hub (https://dxhub.calpoly.edu/): A innovation lab at Cal Poly (funded by Cal Poly and Amazon Webservices) similar to IDEO (https://www.ideo.com/) where an interdisciplinary team tackles design challenges. This newly-started program at Cal Poly has chosen our project and will guide our design process.
- Nexleaf is a nonprofit dedicated to the study of improved cookstove adoption. So far, they have provided 22 thermal data loggers, which record the use of cookstoves over the course of weeks of use.
- Appropriate Technology and People is a Cal Poly IRA (Instructionally Related Activity) presently with about $2,000 to support collaborative poverty mitigation. We will receive additional funds starting September 2020, although likely less than the $5,000 we requested.

Gantt Chart



Notes on Gantt Chart. This chart is similar to that of our original report and includes some previously unmet ambitions. We find our present proposal more realistic for the following reasons:

1) We are allowing a full year to realize the two cycles of development and dissemination.
2) We will start the project on time because of improved communication between MECS and Cal Poly.
3) We have considerable experience in both the technology as well as logistical hurtles. The addition of Professor Hugo brings expertise in dissemination and impact studies.
4) We initiate no new businesses. Instead, existing organizations (including SolCook, Ghana, started with the previous grant) possessing technical and business experience will build ISEC manufacturing capacity.
5) We are building a learning community between collaborators, learning from each other.

Summary of Potential Collaborators

SolCook, Ghana (www.SolarElectricCook.com)
Contact: Kweku Osei kwekusei22@gmail.com
Company started in Nov. 2019

SunFire Solutions, South Africa (https://www.sunfire.co.za/)
Contact: Crosby Menzies crosby@sunfire.co.za
Many years of concentrated solar cooker dissemination

SHE (Solar Household Energy), USA, Mexico and more countries (www.she-inc.org)
Contact: Sophie Brock sophie@she-inc.org
Established conventional solar cooker factory in Tlacolula valley in Oaxaca, Mexico.

PRINCE, (Promoters, Researchers & Innovators in New & Clean Energy), India, (www.princeindia.org/)
Contact: Ajay Chandak solarmanofindia@gmail.com
Many years of concentrated solar cooker dissemination

SOWTech, UK in Malawi, (http://www.sowtech.com/)
Contact: John Mullett johnajmullett@gmail.com
Deliverable objective: Exploration of digital control for resistive heaters.