SPESS Phase II
APEC Project: Demonstration and Promotion of Energy Resilience tool based on Solar-Powered Emergency Shelter Solutions (SPESS) for Natural Disaster in APEC(EWG13 2019A)

Session 2
APEC Sustainable Energy Center(APSEC)

Shan Liu
Marketing Specialist
Outline

- Introduction—APEC Sustainable Energy Center (APSEC)
  - Establishment of APSEC
  - Two Pillar Programs
  - Two Flagship Events

- Case description—APEC Funded Project
  - Project background/General information
  - Project review/Outcome
  - Current work plan and potential cross-fora collaboration
APEC Sustainable Energy Center (APSEC) was established at the 11th APEC Energy Ministerial Meeting in 2014, which was written into the 22nd APEC Leaders’ Declaration. It is a major achievement of the Chinese government responding positively to the initiative of APEC leaders to participate in energy cooperation in APEC region.
APEC Energy Working Group Structure

EWG Lead Shepherd
Mr. Jyuung-Shiauu Chern

EWG Secretariat
Lynn Wan-Ling Wang

Expert Group on Energy Data & Analysis (EGEDA)
Chair: Mr. Masazumi Hirono
Japan

Expert Group on Energy Efficiency & Conservation (EGEE&C)
Chair: Mr. Li Pengcheng
China

Expert Group on Clean Fossil Energy (EGCFE)
Chair: Mr. Scott Smouse
USA

Expert Group on New & Renewable Energy Technologies (EGNRET)
Chair: Mr.Chen Chung-Hsien
Chinese Taipei

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Chair: Mr.Chen Chung-Hsien
Chinese Taipei

Energy Resilience Task Force
Chair: US, Philippines

LCMT Task Force
Chair: Mr. Tomio Horada
Japan

APEC Sustainable Energy Center (APSEC)
President: Prof. Zhu Li
China

Asia Pacific Energy Research Centre (APERC)
President: Mr.kazutomo.irie
Japan
Two Pillar Programs

Research programs, namely **APEC Cooperative Network of Sustainable Cities (CNSC)** and **Clean Coal Technology Transfer (CCT)**. Producing high-level research results and core publications.
Annual Flagship Cities Workshop

APEC Workshop on Sustainable Cities

First
May, 2016
Canberra, Australia

Second
April, 2017
Singapore

Third
May, 2018
Hong Kong, China

Fourth
May, 2019
Taguig City, Philippines
FIVE Years 'Growth

Annual Anniversary Event
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Case Description

• **Background**

Globally, Asia Pacific Region is **highly prone to climate change impact**, 70 percent of all natural disasters happen in the region — such as

• 2008 Earthquake in China's Sichuan province
• 2010–11 Queensland Australia floods & 2011 Thailand floods,
• 2011 Great East Japan Earthquake and the ensuing tsunami,
• 2012 Superstorm Sandy in US,
• 2013 Super Typhoon “Haiyan” hitting eastern Philippines,
• 2014 Ubinas Volcano explosion in Peru
• 2018 Sulawesi earthquakes in Indonesia

— are important reminders of the severe situation APEC community faces.

In 2018, half of the 281 natural disaster events worldwide occurred in the Asia-Pacific region.
Case Description

• Background

1. Low-carbon technology to benefit building resilience

2. APEC 2015’s priority areas was Building Sustainable and Resilient Communities to strengthen APEC community’s energy-resilience and sustainability affected by natural disasters

3. SPESS Phase I proposed by APEC Sustainable Energy Center (APSEC)
   APEC project EWG22 2015A—Developing Solar-Powered Emergency Shelter Solutions (SPESS) as an Energy-Resilience Tool for Natural Disaster Relief in APEC Community.

• General Information

a) Modular emergency shelter integrated solar energy and emergency shelter solutions to assist distressed communities affected by natural disaster;

b) Thin film PV power generation and energy storage system;

c) An energy resilient tool for post disaster resettlement.

Source: www.apec.org

Rainbow Home designed by Tianjin University, School of Architecture
Case Description

• General Information

SPESS Phase I-APEC-Funded Project (EWG222015A) Developing Solar-Powered Emergency Shelter Solutions (SPESS) As an Energy-Resilience Tool for Natural Disaster Relief in APEC Community.

Hanergy MiaSole FLEX CIGS Think-film Solar Module
Case Description

Objectives:

1. To promote low-carbon energy technology innovation in APEC, through advancing the integration of solar energy and emergency shelter technologies in the development of SPESS;

2. To improve capacity of APEC stakeholders (especially those from developing members) in adopting science-based approaches for emergency preparedness and post-disaster response, through harnessing an innovative, low-carbon, energy-resilient technology of SPESS;

3. To develop Recommendations on deploying SPESS that responds to the varying climatic, economic and cultural conditions of APEC member economies, helping bring low-carbon energy measures into the mainstream of APEC’s science-based Disaster Management framework.
Project Review SPESS Phase I

Start-up phase
Project promotion in APEC

Development phase
Academic discussion

Development phase
Call for competition

Finalization phase
APEC Workshop B

(Energy Work Group)
12.2015 - EWG 50
05 2016 - EWG 51
10. 2016 -EWG 52
Pre-research; seek co-sponsorship

First APEC Workshop on SPESS,
Tianjin, China, 07.2016
Discussion on Energy Supply of Post-disaster Emergency Shelter

SPESS Open Innovation Competition
09-10 2016
Call for competition; Innovative SPESS designs

The final APEC Workshop on SPESS,
Tianjin, China, 09.2017
Final project report discussion

SPESS phase I in APEC Project Database:
Project Review SPESS Phase I—First Workshop

The 1st APEC workshop on SPESS in Tianjin University, July 28-29, 2016

30 experts and participants from 10 APEC economies shared the experience of their economies and reached agreements on some mainly topics, such as SPESS Open Innovation Competition and literature survey in emergency shelter and solar energy in APEC region.
**SPESS Open Innovation Competition**

**Name: 3D Puzzle shelter**
Designer: Tianjin University

**Name: Accordion Shelter**
Designer: Huazhong Agricultural University

**Name: Harbour**
Designer: Shijiazhuang Tiedao University

**Name: Rainbow home**
Designer: Tianjin University

If it interests you, you are very much welcome to contribute to & benefit from SPESS project. Let’s work together to make SPESS another quality APEC project.
The Final APEC workshop on SPESS in Tianjin University, November 3-5, 2016

More than 30 APEC experts and participants from China, Indonesia, Malaysia, Philippines, Thailand, Singapore, The United States and Viet Nam have jointed this workshop. Four Innovative SPESS designs shared by different teams from China have called strong attentions and receive comments from APEC Experts. Academic Discussion on project final report.
SPESS Phase I outcome

The literature survey provide information on the potential application of SPESS within the APEC Community. Especially on provide emergency shelter and solar research in the 12 APEC economies.

Based on of previous Literature Survey ;workshops and SPESS open innovation competition. This report sets out recommendations to provide reference information on the potential application of SPESS within APEC region.

Post Disaster Solution

Search For Trapped People

Investigation Of Disaster Scene

The Broken Street

The River Silted Up

Emergency Shelter for rapid construction

Disaster

The life problems that need to be solved after the disaster

Rebuild

Reconstruction work requires a lot of time
Post Disaster Solution

**Duffy Shelter (design by UK)**
Made by Wood; (W)185cm (D)125cm (H)142cm

**Paper Loghouse (design by Japan)**
The walls are made from 106mm diameter, 4mm thick paper tubes.

**Solar tent (design by Italy)**
The tent is made by tarpaulin (50% cotton and 50% acrylic) with six pieces thin film PV modules, total power generation 780W.
Structure Disassembly Graph

- Quickly assemble
- Comfortable living
- Energy self-sufficiency

Thickness: coated steel (0.5mm); insulation board (50mm); expanded polystyrene board (50mm)
Building Shape Generation

Inspired by the way of opening books. Not only can the convenient transportation, but also can expand and function layout quickly, to ensure that local people have a small home for shelter as soon as possible.
Split Style and Lift Scene

The small building can accommodate 4-6 people which is used for a family or a separate individual. It only meets the requirements of the most basic life.

The big building is mainly used as a temporary public building, it can used as a small reading room, a temporary hospital which can accommodate six hospital beds and an operation room or a complex and surgical ward.

ENTERTAINMENT

REST

COMMUNICATE

WORK
Prototype Building

杆件制作 → 实体与设计模型比例 1:2 → 薄膜铺贴

板材加工 → 零件组装 → 光伏安装
Energy System Analysis

Thin Film Photovoltaic Module → Controller → Off-grid Inverter → Digital Telephone, Laptop, Radio, Electric Fan, Battery pack → LED Lamp

Selection of off-grid photovoltaic power generation system

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Specification</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV lead-acid battery</td>
<td>24V/250Ah</td>
<td>4</td>
</tr>
<tr>
<td>PIN/PIN/PIN triple-junction a-SiGe solar cell</td>
<td>50W/1245mm*635mm</td>
<td>10</td>
</tr>
<tr>
<td>PV controller</td>
<td>24V/20A</td>
<td>1</td>
</tr>
<tr>
<td>PV inverter</td>
<td>24V-220V/2000W</td>
<td>1</td>
</tr>
</tbody>
</table>

Energy consumption analysis of power equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Power</th>
<th>Time</th>
<th>Number</th>
<th>Power Consumption</th>
<th>Power Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Led lamp</td>
<td>23W</td>
<td>6h/day</td>
<td>2</td>
<td>0.276kWh/day</td>
<td>1.296kWh/day</td>
</tr>
<tr>
<td>Electric Fan</td>
<td>50W</td>
<td>3h/day</td>
<td>2</td>
<td>0.30kWh/day</td>
<td></td>
</tr>
<tr>
<td>MT</td>
<td>60W</td>
<td>3h/day</td>
<td>4</td>
<td>0.72kWh/day</td>
<td></td>
</tr>
</tbody>
</table>

Technology provider: Hanergy
Product: MiaSole FLEX CIGS
APSEC was approved a new APEC funded project (SPESS Phase II) —Demonstration and Promotion of Energy Resilience tool based on Solar-Powered Emergency Shelter Solutions (SPESS) for Natural Disaster in APEC (EWG13 2019A)

Main Objective: carry out outcome of EWG 22 2015A—provide technical support, establish workshop and technical training to engage key APEC stakeholders, and establish demonstration project in China and other susceptible economies to natural disasters.

APSEC approved a new APEC funded project (SPESS Phase II) —Demonstration and Promotion of Energy Resilience tool based on Solar-Powered Emergency Shelter Solutions (SPESS) for Natural Disaster in APEC (EWG13 2019A)

Main Objective: carry out outcome of EWG 22 2015A—provide technical support, establish workshop and technical training to engage key APEC stakeholders, and establish demonstration project in China and other susceptible economies to natural disasters.

<table>
<thead>
<tr>
<th>Project No.</th>
<th>EWG13 2019A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Status</td>
<td>Endorsed by APEC EWG in 2019</td>
</tr>
<tr>
<td>Proposed by</td>
<td>China</td>
</tr>
<tr>
<td>Co-Sponsoring Economies</td>
<td>Indonesia; Thailand; Papua New Guinea; Philippines; Hong Kong, China; Australia</td>
</tr>
<tr>
<td>Expected Start and Completion Date</td>
<td>11/2019 to 12/2020</td>
</tr>
</tbody>
</table>

Accounting for 70 percent of all natural disasters, the Asia Pacific is highly prone to climate change impacts. This project will promote application and demonstration of total solution of energy supply and comfortable indoor environment for ERSS (Emergency Resilient Shelters). Based on SPESS, emphasizing the characteristics of people-oriented, promoting the application of sustainable, high energy efficiency and environmental protection, and responding to APSEC’s concept about “cooperation, safety, security, efficiency, green technology, and comprehensive development”. This project aims to solve the key problems faced by disaster relief in the Asia Pacific region such as the energy supply and the basic living guarantee. This project will carry out outcome of SPESS’ open innovation competition (EWG 22 2015A), provide technical support, establish workshop and technical training to engage key APEC stakeholders, and establish demonstration project in China and other susceptible economies to natural disasters.
## SPESS Phase II (EWG13 2019A)—Work Plan

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Key Activities</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov.2019 to Jan 2020</td>
<td>1) Status quo survey of energy-supply for ERS during post-disaster relief in APEC; 2) Determine work objective of Energy Supply Solution tool based on SPESS; 3) Formulate the work plan, implement demonstration and development.</td>
<td>Survey report/ Creation plan</td>
</tr>
<tr>
<td>Feb. to March. 2020</td>
<td>1) Host economy prepares a background briefing 2) Analyse technology issue that invited APEC members facing on disaster relief</td>
<td>Notice of participation/Meeting material</td>
</tr>
<tr>
<td>April to May 2020</td>
<td>Workshop A: 1) Develop training programs, organize training and promotion activities. 2) Selection of volunteer APEC economies for future pilot project; organizing technical visit and communication in Manado, Indonesia.</td>
<td>Technical visit / Promotional activities/ SPESS product display</td>
</tr>
<tr>
<td>June to July 2020</td>
<td>1) Workshop A summary; feedback collection 2) Preparation for Workshop B</td>
<td>Summary report</td>
</tr>
<tr>
<td>Aug to Oct. 2020</td>
<td>Workshop B: 1) Carry out technical analysis of SPESS, organizing technical seminars 2) Discussion on develop pilot project in volunteer APEC economies (implementation plan and recommendations)</td>
<td>Technical analysis /Discussion</td>
</tr>
<tr>
<td>Nov to Dec 2020</td>
<td>1) Project summary; Finalization of Recommendations based upon outcomes of previous survey &amp; workshops 2) Preparation of pilot project implement in following year</td>
<td>Project Summary / develop pilot project</td>
</tr>
</tbody>
</table>
Plan on Workshop A

- Tentative location: Manado, North Sulawesi Province, Indonesia
- Date: April to May 2020
- Objectives: **Cross-fora collaboration with PPSTI to enhance project outcomes.**

1. **Technology transfer**: School-based training programs on SPRESS technology, such as:
   1) Rainbow Home Kit Training (assemble, deployment, and operation etc.);
   2) Renewable Energy Technology (building integrated PV; smart power/self-sustained green community);
   3) Knowledge/technology exchange on disaster management (Big data on: pre-response and post-disaster situations)

2. **Pilot project establishment**: selection of volunteer APEC economies for Rainbow Home deployment
   1) Background briefing on disaster relief (such as, disaster relief mechanism);
   2) Organizing technical visit (potential project location).

3. **Joint research**: Input on final project report (literature survey, performance simulation, parameter optimization, experimental data analysis etc.)

4. **Other potential collaborations are welcome...**
Plan on Workshop B

- Location: Tianjin, China
- Date: Aug to Oct. 2020
- Objectives: **Implementation plan and project recommendations.**

1. Based on workshop A outcome,
   1) Organizing technical seminars to carry out technical analysis of Rainbow Home;
   2) Draft up project implementation plan;
   3) Formulate integrated solution on efficient disaster relief mechanism for natural disasters and investment in disaster risk reduction in APEC.

2. Finalize project report,
   Receive comments and evaluations from APEC experts.
THANK YOU!