APEC Sustainable Energy Center

Progress Report on Study on the Cost-Effective Renewable Energy-Supply Solutions based on Innovative Solar Technologies to Promote Green Buildings in APEC Region—EWG 03 2016A

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Part 1. Introduction of Project

Project No.	EWG 03 2016A
Project Title	Study on the Cost-Effective Renewable Energy-Supply Solutions based on Innovative Solar Technologies to Promote Green Buildings in APEC Region
Project Status	Project in Implementation (approved in Session 1, 2016)
Fund Account	APEC Support Fund (ASF)
Fund Account	149,983
Proposed by	China
Co-Sponsoring Economies	Canada; Hong Kong, China; Malaysia; Singapore; Chinese Taipei; United States
Expected Completion Date	31/12/2017

SECTION A: Relevance to APEC

Relevance:

- **Buildings account for about 40% of the global energy consumption and contribute over 30% of the carbon dioxide emissions**
- This project directly responds to APEC Energy Ministers' instruction for the EWG (through their **2015 Cebu Declaration**) to "*explore strategies to drive the shift towards green buildings including zero energy buildings*"
- It is also responsive to specific priorities of the **Work Plan for 2016 APEC EWG**: "Sustainability", which indicates that "Leaders endorsed in Beijing the establishment of the APEC Sustainable Energy Center (APSEC) in 2014 to facilitate cooperation on sustainable energy development across the APEC region
- This project falls under **Rank 2 on 2016 APEC Funding Criteria**, as it evidently relates to *Energy efficiency, energy security and energy resiliency including the development of low carbon technology and alternative energy sources*
- This project seeks to foster APEC members' collaborative efforts in developing cost-effective renewable energy-supply technology for green buildings in APEC region

SECTION A: Relevance to APEC

Objectives:

1. **To develop recommendations on technical solutions for promoting advanced solar applications in green buildings to Asia Pacific's various climatic regions.**
2. **To make all partners clear about possible sustainable building energy-supply solutions and to enhance understanding of the innovative solar technologies by sharing results and experiences.**
3. **To build interest of governments, investors, architect, manufacturers of building cladding products and photovoltaic companies in the innovative solar technologies and their applications for green buildings including zero energy buildings.**

For detailed information about this project, please visit the following Links

in APEC Project Database:
https://aimp2.apec.org/sites/PDB/Lists/Proposals/DispForm.aspx?ID=1859

Or simply type project name into APEC Project Database Search Engine.

SECTION B: Project Impact

Outputs:

1. **Literature survey** on practice of renewable energy applications and energy supply solutions
2. **Research report** on innovative solar technologies
3. **A technical solution package** about renewable energy-supply for green building
4. **A Workshop** focus on renewable energy-supply solutions for green buildings
5. **Promotion plan** about how to facilitate and accelerate the spread and adoption of the cost-effective renewable energy-supply solutions for green buildings in APEC region.
6. **A website** about the innovative solar technologies by sharing results and experiences.
7. **Final project report** on renewable energy supply solutions for green buildings in APEC Region.

SECTION B: Project Impact

Outcomes:

- The awareness and knowledge of APEC's relevant stakeholders on the innovative solar technologies is expected to be significantly improved
- Developing renewable energy-supply solutions can contribute to the growth of APEC's renewable energy (e.g. solar PV), expand and upgrade the practical application of renewable energy technologies in green buildings industry, improve members' innovation capability in low-carbon energy technologies
- The project also has the great potential to lead to the actual deployment of the innovative solar technologies as energy-supply solutions for green buildings in APEC community over the next few years.

Beneficiaries :

- The government officials and regulators
- Researchers and experts in the field of renewable energy and and green building
- Manufacturers of solar industry (Photovoltaic module / Solar Collector)
- Green building project developer and investors

SECTION C: Project Effectiveness

Monitoring and Evaluation:

- **A literature survey report and a research report** on related technologies will be completed A workshop with 12 experts/speakers and attendance of at least from APEC economies of renewable energy and green buildings field will be held
- **A promotion plan** will be completed according to economic and commercial promotion research, and feedback from the workshop.
- The project overseer will **encourage female experts and professionals** for a minimum percentage of 30% to attend the research process.
- **Number of publications** (e.g. Final research report on RE energy supply solutions for green buildings in APEC Region, Economic and commercial promotion research report) can download from website.

SECTION C: Project Effectiveness

Linkages:

- **This project will keep in contact with the chairpersons of relevant APEC fora**, such as Expert Group on New and Renewable Energy Technologies (EGNRET) & Expert Group on Energy Efficiency and Conversion (EGEEC) to ensure that we are making full use of their resources and are not duplicating any of their activities.
- **The cross fora collaboration is definitely expected**, e.g. between EGNRET and EGEEC, LCMT TF, ESCI & Energy Resilience TF.
- **We will also consult with international organizations** such as International Energy Agency (IEA) which might have knowledge of renewable energy policy where necessary, and take full advantage of the interaction with energy experts at EWG meetings
- Further, there will be very good interaction, strengthen cooperation and complementarity between my APEC project and the existing APEC project**: EWG 02 2015A** - APEC Nearly (Net) Zero Energy Building Best Practices and Energy Reduction Results Comparative Study.

SECTION D: Project Progress

1st Workshop, 3-5 Nov. 2016:

Workshop Title	Date	Venue
The 1st APEC Workshop on Cost-Effective Renewable Energy-Supply Solutions to Promote Green Buildings	3-5 Nov. 2016	Tianjin, China

- 9 experts (6 of them are APEC funded) and 5 Economy Representatives (Chinese Taipei, Malaysia, Thailand, Indonesia and Chile) attended the workshop

APEC Sustainable Energy Center

SECTION D: Project Progress

APEC Project Monitoring Report:

Appendix F

APEC Project Monitoring Report

Please submit through your APEC Secretariat Program Director by August 1 and February 1 of each year.

SECTION A: Project profile

Project number & title:	**EWG 03 2016A-Study on the Cost-Effective Renewable Energy-Supp Solutions based on Innovative Solar Technologies to Promote Greer Buildings in APEC Region**		
Time period covered in report:	July 2016 – Jan. 2017	**Date submitted:**	Feb. 01 2017
Committee / WG / Fora:	**EWG**		
Project Overseer Name: **Organization / Economy**	**Yong Sun** **APEC Sustainable Energy Center**		

SECTION B: Project update

Briefly answer each of the questions below to a maximum of 2-3 pages. If you have submitted previous Monitoring Reports, focus on progress since the last report.

1. Current status of project:

- **On schedule: YES √ / NO**
- **On budget: YES √ / NO**
- **On target to meet project objectives: YES √ / NO**

If NO, provide details: How far off schedule, budget or objectives? What actions are being taken to resolve delays? What support is needed from your Committee or the Secretariat?

2. Implementation: Describe progress against the project work plan and proposed objectives.

- **Were adjustments made to the scope or timing of the project?**
- **What outputs (e.g. agenda, report, workshop, tools, best practices) have been delivered? How have/are these outputs being utilised?**

(1) The project aims to develop recommendations for application of innovative solar technologies in green buildings to Asia Pacific's various climatic regions, share information on relevant technologies, and promote energy efficiency of APEC region. A final research report on RE solutions for green buildings in APEC Region will be prepared for publication. On the whole, the work plan of this project has been implemented as planned.

In order to ensure a smooth start of the project, we applied to add an extra Seminar/Workshop on Aug. 31 2016 and finally got approval. We have successfully held the added workshop *"The 1st APEC Workshop on Cost-Effective Renewable Energy-Supply Solutions based on Innovative Solar Technologies to Promote Green Buildings"* on Nov. 3-5 2016 at Tianjin China. Now, according to the work plans, we are preparing the final workshop which plans to be held in April 2017 at Singapore. A contract for Literature survey, Technical solution package, Promotion plan, and workshop consultation is going to be started recently as well.

(2) The main outputs by now are as follows:

"The 1st APEC Workshop on Cost-Effective Renewable Energy-Supply Solutions based on Innovative Solar Technologies to Promote Green Buildings" was successfully held on Nov. 3-5 2016 at Tianjin China. The Workshop aims to develop recommendations on technical solutions for promoting advanced solar applications in green buildings to Asia Pacific's various climatic regions, to make all partners clear about possible sustainable building energy-supply solutions and to enhance understanding of the innovative solar technologies by sharing results and experiences, to build interest of governments, investors, architect, manufacturers of building cladding products and photovoltaic companies in the innovative solar technologies and their applications for green buildings including zero energy buildings.

9 experts (6 of them are APEC funded) and 5 Economy Representatives (Chinese Taipei, Malaysia, Thailand, Indonesia and Chile) attended the workshop.

We luckily invited Dr Chung-Hsien Chen, Chair of EGNRET to attend this workshop as Expert. Dr. Chung-Hsien CHEN made a report on "*Next Steps toward Achieving Renewable Energy Goal in APEC region*". Participants from Chinese Taipei, Malaysia, Thailand, Indonesia and Chile reported on development status and existing problems on green buildings and local solar energy technology applications . Experts from **university (***including Plymouth University, Cornell University and Tianjin University*), Enterprises (*including Shenzhen institute of Building Research Co., Ltd. China, China Construction Science &Technology Group Co.,Ltd., China*) and research institutions (*China New Energy Chamber of Commerce, Fund Division of China National Building Research Association , International Academy of Low Carbon Development Shenzhen, China*) focused on introduction and sharing to concepts, application status of related techniques and **techno-economic analysis and application scheme for different climate zones.** All participants and expert gave a high evaluation on this workshop.

3. Evaluation: What are the indicators developed under the project to measure progress/success? Has baseline information or evaluation results been collected? How will any potential impacts on gender be measured? If relevant please provide details.

The project is evaluated using the following criteria:

(1) A literature survey report and a research report on related technologies will be completed according to surveys (including but are not limited to survey on renewable energy application in building, present developing condition of green building in different APEC economies, climate characteristics, current situation of related product market), expert interviews, on-site investigation and etc.

(2) Workshop with 12 experts/speakers (minimum 5 female) and attendance of at least 50 (minimum 20 female) from APEC economies of renewable energy and green buildings field will be held.

We have successfully held the *"The 1st APEC Workshop on Cost-Effective Renewable Energy-Supply Solutions based on Innovative Solar Technologies to Promote Green Buildings"* on Nov 03-05 2016, we invited nine experts (six of them are APEC funded) and five Economy Representatives (Chinese Taipei, Malaysia, Thailand, Indonesia and Chile).

(3) A promotion plan will be completed according to economic and commercial promotion research, and feedback from the workshop.

(4) The project overseer will encourage female experts and professionals for a minimum percentage of 30% to attend the research process.

(5) Number of publications (e.g. Final research report on RE energy supply solutions for green buildings in APEC Region, Economic and commercial promotion research report) can download from website.

The PO and the project think-tank strive to keep the project on the right track through meeting key milestones along the project timeline. Submitting this APEC project monitoring report is also conducive to fulfilling the above goal.

4. Challenges: If not covered in Q1, describe any issues which impacted (or might still impact) on the effective delivery of the project. How have these affected the objectives, deliverables, timeline or budget? What are the risk management strategies in place to manage potential or real risks

(1) Different conditions of different member economies. Different APEC member economies might have quite different climate conditions and natural energy resources, thus the performance investigation results to a specific economy don't necessarily fit to another.

The project overseer plans to achieve further performance results and to carry out optimization analysis by means of simulation to make sure the research could cover as much as possible main application solutions.

(2) Lack of participants. There is generally a risk that workshops do not attract the optimal range and number of participants. However, the project overseer already has long-term history of cooperation with the key organizations to be involved. That will help using all partners networks to convince the participants to join. This risk can further be managed by using a range of communication channels to promote the workshop; holding it alongside another relevant event, providing adequate notice of the confirmed date and venue, and assisting with travel expenses for travel-eligible economies.

(3) Possible delay in finalizing report and uploading documents. The project overseer will ensure sufficient time to prepare seminar report and adhere to strict internal deadlines.

5. Engagement: Describe the engagement and roles of stakeholders in the implementation of the project, including other APEC fora, experts and participants.

Developing green buildings including zero energy buildings by using renewable energy is a common and urgent problem, all APEC and non-APEC members could be engaged.

- This project will focus on applications of renewable energy in building area, trying to promote some advanced ideas and approaches on technology innovation, and relevant stakeholders, i.e. not only insiders of PV industry but also the representatives from building industry in the APEC region, will be encouraged and attracted to attend this project. This project could also engage world-leading solar research groups (e.g. NREL of US, ITRI of Chinese Taipei, ANU of Australia etc.).
- This project will keep in contact with the chairpersons of relevant APEC fora, such as Expert Group on New and Renewable Energy Technologies (EGNRET) & Expert Group on Energy Efficiency and Conversion (EGEEC) to ensure that we are making full use of their resources and are not duplicating any of their activities.
- We will also consult with international organizations such as International Energy Agency (IEA) which might have knowledge of renewable energy policy where necessary, and take full advantage of the interaction with energy experts at EWG meetings. The cross fora collaboration is definitely expected, e.g. between EGNRET and EGEEC, LCMT TF, ESCI & Energy Resilience TF.
- This project builds on but does not duplicate previous projects on solar PV and green/NZEB buildings through fostering collaborative efforts in developing a cost-effective and innovative poly-generation (i.e. power, heating & cooling) solar energy system, which can be effectively integrated into green buildings as an essential technical strategy.

FOR APEC SECRETARIAT USE ONLY *APEC comments: Is the project management effective? How could it be improved? Are APEC guidelines being followed?*

SECTION D: Project Progress

Next Stage Work:

- The final workshop which plans to be held during 2nd half year of 2017 is being preparing.
- Two contracts (one for Literature survey, Technical solution package, Promotion plan; one for final workshop consultation) are going to be started recently.

Part 2. Innovative Solar Energy Technologies of APSEC

Flat Solar

- Co-generation solar Panel
- Poly-generation PV

Concentrated Solar

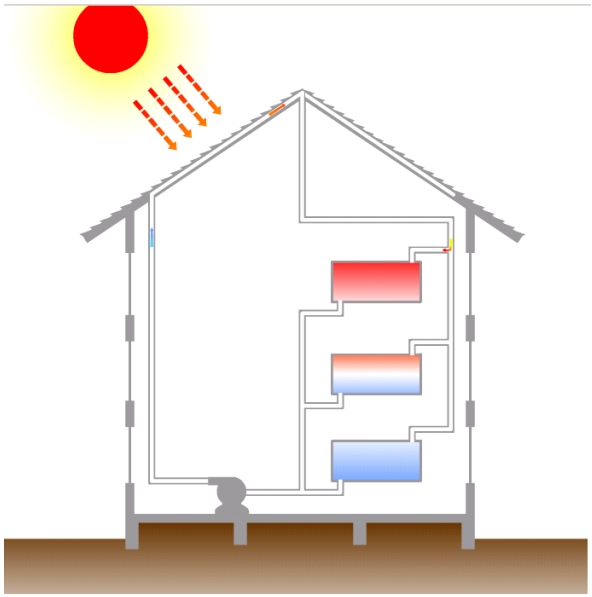
- Transmission
- Reflection
- Fresnel, Linear Flat Mirror, V-trough
- Water purification
- Liquid-immersion cooling

- Wall/roof
- Window/skylight
- Curtain/sunshade
- Etc.

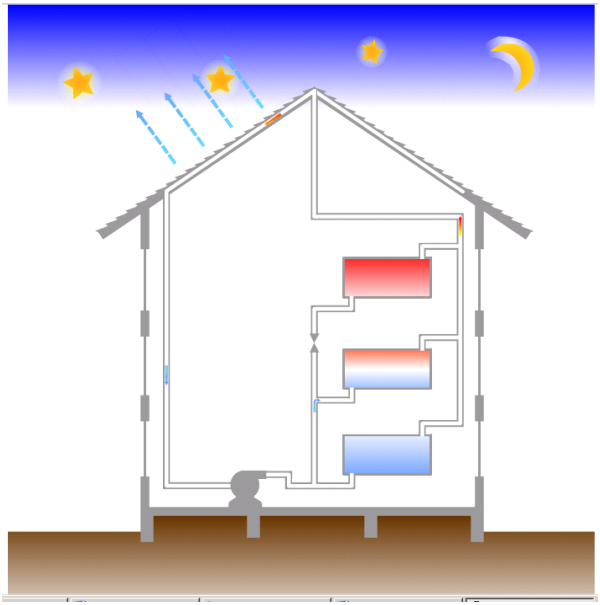
- Seasonal energy storage
- Very low temperature end
- Multi-source heat pump

Flat Solar Technology and Building Integration

- Heating and cooling solar radiant panel



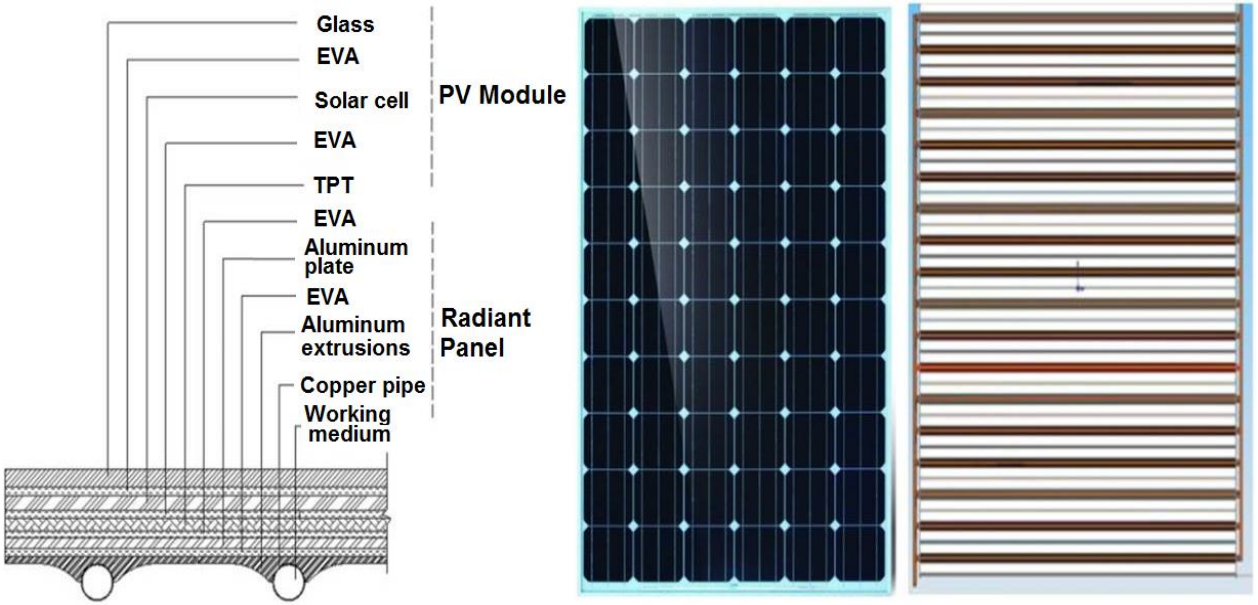
Heat collecting



Cold collecting

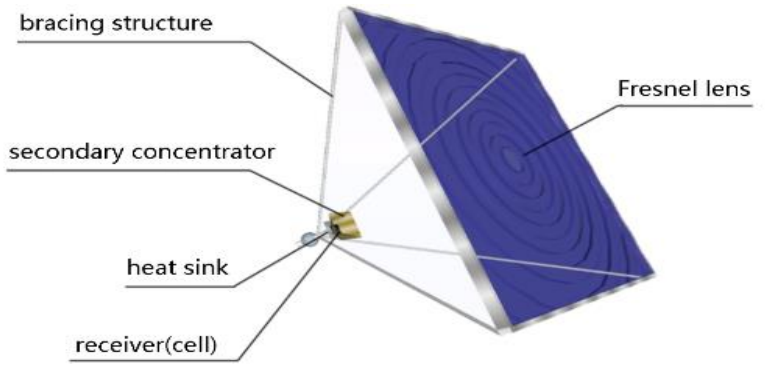
Flat Solar Technology and Building Integration

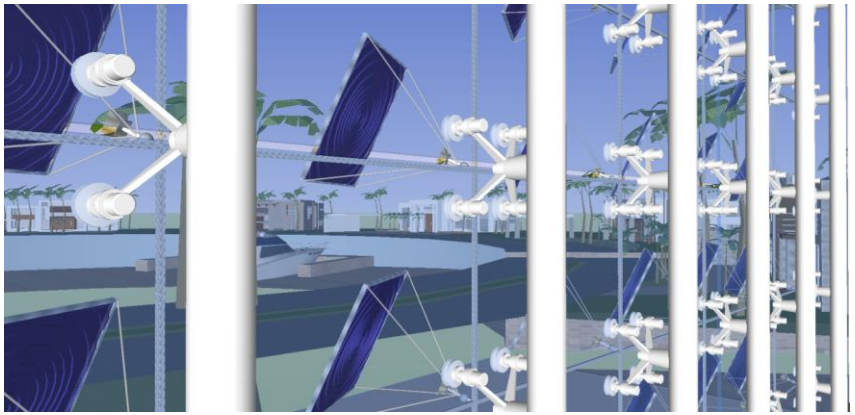
- **Poly-generation (i.e. power, heating & cooling) PV module**

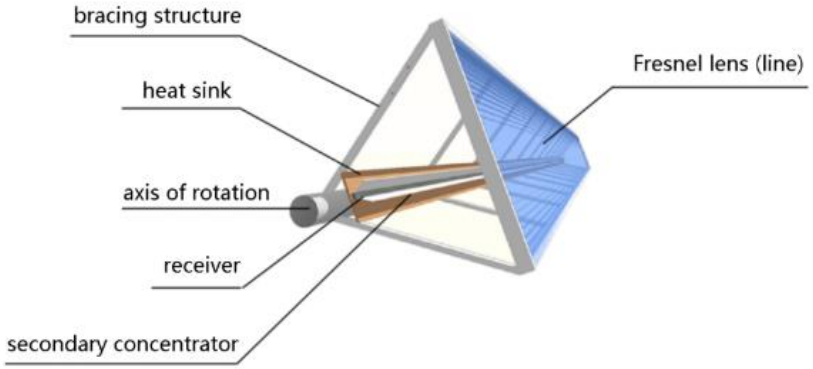


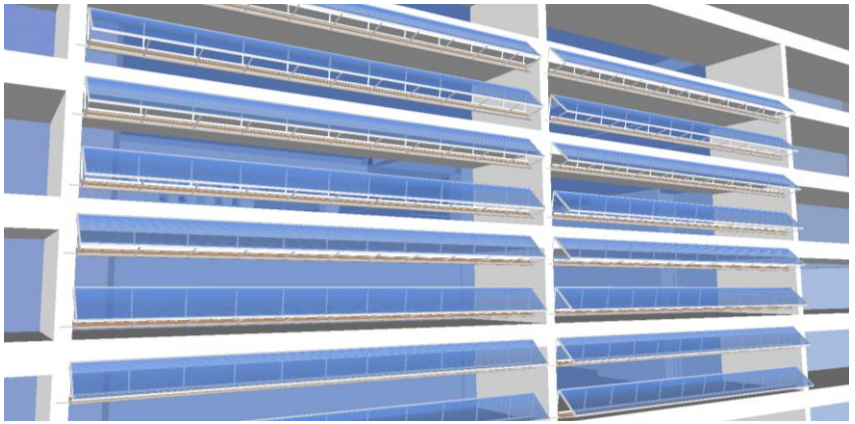
Concentrated Solar Technology and Building Integration

- **Dynamic Concentrating Solar Building Skin**



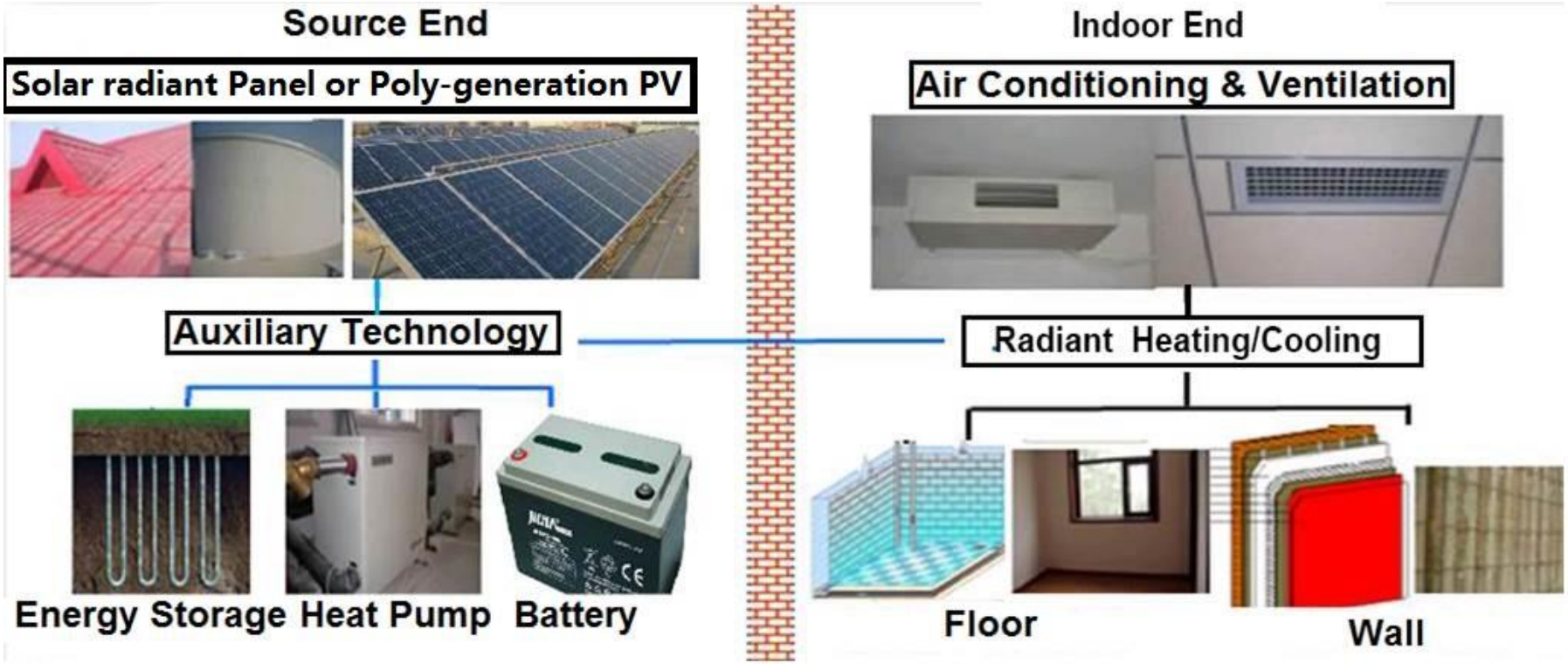






Building Integrated Solar solution

- **Multi-functional building energy systems**



Typical Demonstration Projects

- **Net Zero Energy Consumption Buildings**

The work of Tianjin University for 2010 Solar Decathlon of Europe
——Sunflower House (72 m²)

Net Zero Energy Consumption Complex Building in Dongying City
Shandong Province, China (2000 m²)

Thanks for your attention!

Do feel free to share any thoughts/ideas/suggestions on this project anytime.
The more, the merrier.
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"Joining Hands Toward Sustainable Energy Development in the Asia-Pacific Region."