

29 March 2017

49th Meeting of APEC-EGEE&C

Jeju Island, Republic of Korea



**Asia-Pacific  
Economic Cooperation**

## EWG 02-2015A、EWG 15-2016A、CN of 2018 APEC Nearly/Net Zero Energy Building Program

**Project Overseer: Prof. XU WEI**

**Project Contact: Mr ZHANG Shicong**

**Institute of Building Environment and Energy**

**China Academy of Building Research**



# APEC Program-- Nearly (Net) Zero Energy Building

## Project Background

### (1) APEC GOAL

As of 2035, APEC's aggregate energy intensity will be reduced by 45 percent by, using 2005 as a base year.

- “EWG-03-2013A: Nearly (Net) Zero Energy Building
- “EWG-02-2015A: - APEC NZEB Best Practices and Energy Reduction Results Comparative Study
- “EWG-15-2016A: APEC Nearly (Net) Zero Energy Building Roadmap Study responding to COP21

## 2 meetings of EWG 03 2013A: Nearly (Net) Zero Energy Building

### 1<sup>st</sup> APEC-Net Zero Energy Building workshop



20 economies  
21 speakers  
80 participants

Beijing, China.  
30-31, Oct, 2013

### 2<sup>nd</sup> APEC workshop on Nearly/Net zero energy building & Community



20 economies  
21 speakers  
80 participants

22-23, Oct 2014  
China, Beijing

## 2 meetings of EWG 02 2015A: Nearly (Net) Zero Energy Building

### 3<sup>rd</sup> APEC-CZEBS iSBE Smart Net Zero Resilient Buildings and Communities Net Zero Built Environment Symposium



21 economies  
35 speakers  
130 participants

Aug 2015 Montreal

### 4<sup>th</sup> APEC workshop on Nearly/net zero energy building— From best practices to mass market Built Environment Symposium



11 economies  
8 speakers  
35 participants

April 2016 Taichung

# APEC Program--Nearly (Net) Zero Energy Building

**FINAL REPORT**

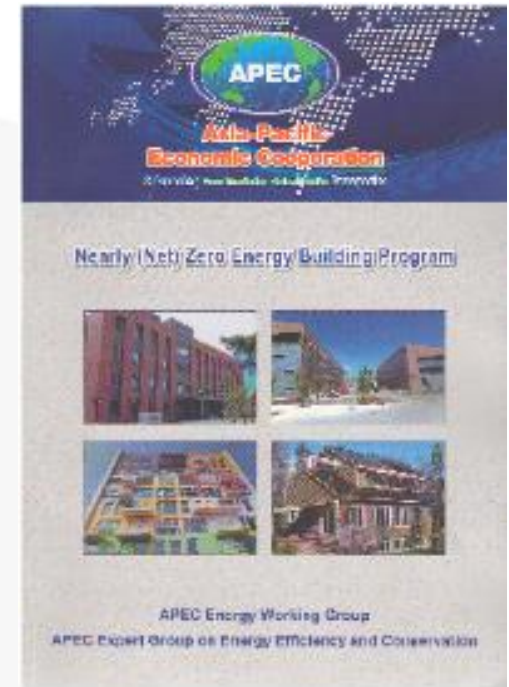
## Focus Area:

- Net Zero Energy Building Definition and Policy
- Research Program outcomes and Technology roadmap
- Pilot projects among APEC economies.
- Related associations and alliances

**Accessed: 3, 027**

**Check Date : 2017-3-27**

Download address: [http://publications.apec.org/publication-detail.php?pub\\_id=1595](http://publications.apec.org/publication-detail.php?pub_id=1595)



# EWG-02-2015A--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## Focus Area:

- Comprehensive and systematic information collecting template on existing NZEB demonstration projects
- Large scale investigation on existing and under built NZEB best practices around APEC regions
- Comparative study of different NZBE pilot project best practices

# EWG-02-2015A: APEC NZEB Best Practices and Energy Reduction Results Comparative Study

**EXPERTS GROUP**

A full scale expert group was established during EWG-02-2015A, 38 speakers and 20 senior experts from 13 economies contribute their effort to this program.

Australia



Usha Iyer-Raniga  
Head  
International  
RMIT University

Canada



Dr. Andreas Athienitis  
Director  
Concordia University  
NSERC  
SNEBSRN

China



Dr. Wei Xu  
Director  
China Academy of  
Building Research

Hong Kong



Dr. Margaret Kam  
Construction  
Industry Council

Japan



Dr. Masaya Okumiya  
Professor  
Nagoya City  
University

Japan



Dr. Gyu young Yoon  
Nagoya City  
University

Korea



Dr. Dongwoo Cho  
Senior Researcher  
Korea Institute of  
Civil Engineering  
and Building  
Technology

The United States



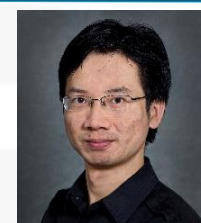
Dr. Edward Mazria  
Founder and CEO  
Architecture 2030

China



Dr. Yu Zou  
Director  
China Academy of  
Building Research

The United States

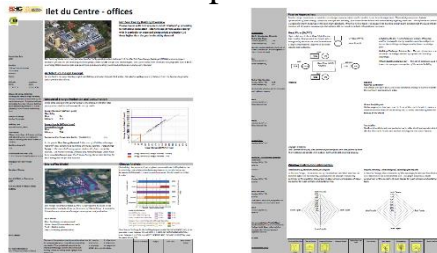


Dr. Wei Feng  
Lawrence Berkeley  
National Laboratory

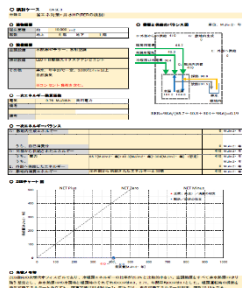
# EWG-02-2015A: APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## Support materials for NZEB best practices template design

(1) IEA Joint SHC Task 40 Building information template



(2) Japan NZEB template



## BEST PRACTICES TEMPLATE DESIGN

(3) China Passive ultra-low energy consumption of green building projects investigation

Project Information			
Project Name	Project Address	Project Type	Project Status
Project Start	Project End	Project Location	Project Description
Project Owner	Project Designer	Project Contractor	Project Consultant
Project Architect	Project Engineer	Project Manager	Project Coordinator
Project Designer	Project Contractor	Project Consultant	Project Coordinator

Energy Performance			
Energy Consumption (kWh/m <sup>2</sup> /Year)	Energy Intensity (kWh/m <sup>2</sup> /Year)	Energy Efficiency (%)	Energy Reduction (%)
Energy Source (%)	Energy Source (%)	Energy Source (%)	Energy Source (%)
Energy Source (%)	Energy Source (%)	Energy Source (%)	Energy Source (%)
Energy Source (%)	Energy Source (%)	Energy Source (%)	Energy Source (%)
Energy Source (%)	Energy Source (%)	Energy Source (%)	Energy Source (%)

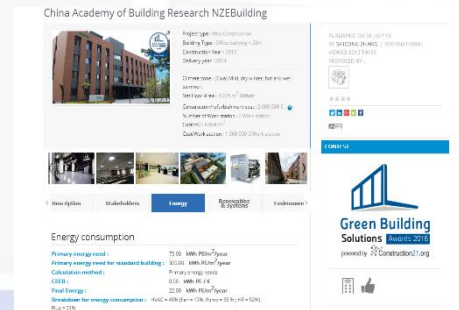
The United States DOE NREL building database



ENOB energy-optimized construction database



Construction 21 building database



# EWG-02-2015A: APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## APEC NZEB best practices template design

**BEST PRACTICES  
TEMPLATE DESIGN**

APEC Nearly (Net) Zero Energy Building Best Practices Information Collection Template			
<b>Basic Information</b>			
Building Name	Location (City)		
Building Type	<input type="checkbox"/> Residential <input type="checkbox"/> Office <input type="checkbox"/> School <input type="checkbox"/> Others (Please Specify)_____		
Heating Degree Day	Cooling Degree Day		
Net Floor Area (m <sup>2</sup> )	Treated floor area (m <sup>2</sup> )		
Number of storeys	F/ BF	Completion Date	
Cost USD /m <sup>2</sup> (Net Floor area)	Cost USD/m <sup>2</sup> (of typical similar building)		
Incremental Cost Allocation (%)	<input type="checkbox"/> Passive approaches ( % ) <input type="checkbox"/> Active approaches ( % )		
Source of Incremental Cost	<input type="checkbox"/> Renewable energy system ( % ) <input type="checkbox"/> Control system ( % )		
Incremental Cost	<input type="checkbox"/> Government Subsidy ( % ) <input type="checkbox"/> Project Incentive ( % )		
Incremental Cost	<input type="checkbox"/> Self-fund ( % ) <input type="checkbox"/> Donation/Industry in-kind support ( % )		
Contact Person	Name	E-mail	Institute/Company
<b>Key Technical Indexes</b>			
Energy consumption	Energy Consumption Targets	Design Value	Average value for typical similar building
	Heating load (W/m <sup>2</sup> )		
	Cooling load (W/m <sup>2</sup> )		
	Annual Heating Demand (kWh/m <sup>2</sup> a)		
	Annual Cooling Demand (kWh/m <sup>2</sup> a)		
	Primary Energy Consumption kWh/(m <sup>2</sup> )		
	Source to Site Conversion Factor (Electricity)		
Primary Energy Consumption Including:	<input type="checkbox"/> Heating <input type="checkbox"/> Cooling <input type="checkbox"/> Lighting <input type="checkbox"/> Plug		
Building energy codes or standards			
Construction Elements	Technical Indicator	Design Value	Standard Value
	Roof U-value (W/m <sup>2</sup> K)		
	Wall U-value (W/m <sup>2</sup> K)		

(Building Envelope)	Window U-value (W/m <sup>2</sup> K)			
	Solar heat gain coefficient (SHGC)			
	Air tightness (m <sup>3</sup> /m <sup>2</sup> h@50Pa)			
Renewable Energy	Energy Category	Main Parameters		
	Solar Thermal			
	Photovoltaic			
	Biomass -fixed Boiled			
	CHP			
	Wind Turbine			
	Air Source Heat Pump			
	Ground Source Heat Pump			
	Total Energy Supply kWh/m <sup>2</sup>			
	Indoor environment	Indoor Temperature (°C)		
Indoor Relative Humidity ( % )				
Indoor Air Quality (CO <sub>2</sub> ppm)				
<b>Energy saving approaches (Yes for ✓)</b>				
Passive Approaches	Skylight	Solar Tubes	Thermal Zoning	Passive Solar Heat Gain
	Site Vegetation	Natural Ventilation	Ground Cooling	Sun shading
	Others (Please Specify)			
	Energy Efficient Lighting	Advanced Lighting Controls	Efficient Appliances	Load Management
	Mechanical Air Heat Recovery			
Active Approaches	Displacement Ventilation	Radiant Heating	Radiant Cooling	Air Source Heat Pump
	Hot Water Heat Recovery			
	Other (Please Specify)			

The template have been sent to:  
18 experts over 8 economies:  
100 feedbacks were chosen to contribute this final report.



# EWG-02-2015A: APEC NZEB Best Practices and Energy Reduction Results Comparative Study

**BEST PRACTICES  
INVESTIGATION**

Participants from 9 APEC economies responded to the survey

APEC economies with VFEL	Survey	Number of best practices that investigated	Number of best practices that are disclosed
Australia	√	2	2
Canada	√	7	7
China	√	34	34
Hong Kong, China	√	1	1
Japan	√	20	6
Republic of Korea	√	10	10
Singapore	√	1	1
US	√	24	22
Chinese Taipei	√	1	1

# APEC-Net Zero Energy Building Best Practices



**Xu Wei**  
 Director of Institute of Building Environment and Energy,  
 China Academy of Building Research  
 CARR Net Zero Energy Building



**Kevin Mo**  
 Program Director Energy Foundation  
 Buildit Centre-A Net Zero Energy Building in Seattle



**Andrew Asheritis**  
 Director, NRESRC Smart Net-zero Energy Buildings Strategic Research Network  
 Concordia Centre for Zero Energy Building Studies  
 ResTech™ iQcellular™ Home



**Donggeon Cho**  
 Head, Senior Research Fellow, Ph.D  
 National Green Building Center  
 Korea Institute of Civil Engineering and Building Technology  
 Korea Zero Carbon Green House



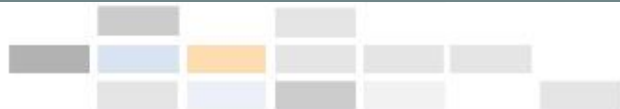
**Hideohara Niwa**  
 Chairman of SHASE-NEED Group  
 Executive General Manager of Nihonon Sekai  
 Research Institute  
 Shintan Corporation Net Zero Headquarter



**Thomas Ray Hostman**  
 Director of Sustainability, ENL  
 Architect of NREL-RIF  
 Research Support Facility  
 National Renewable Energy Laboratory



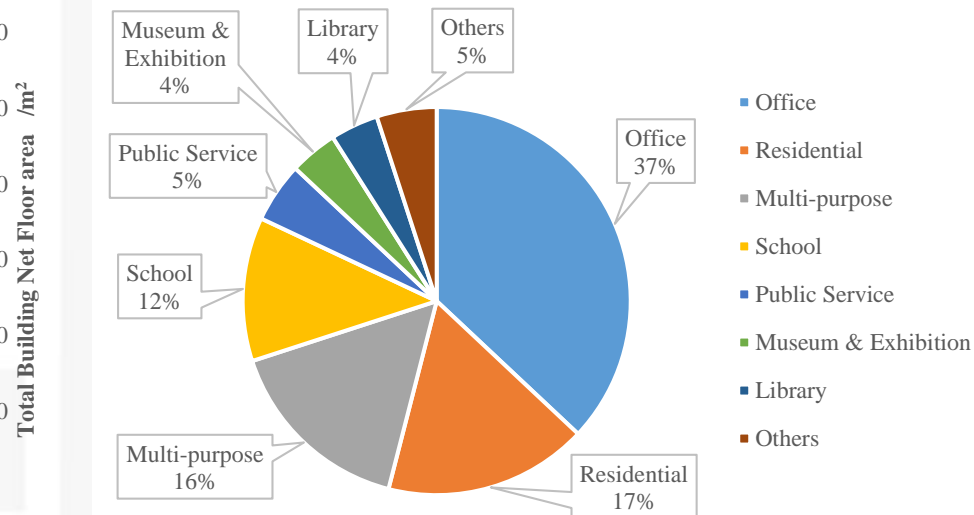
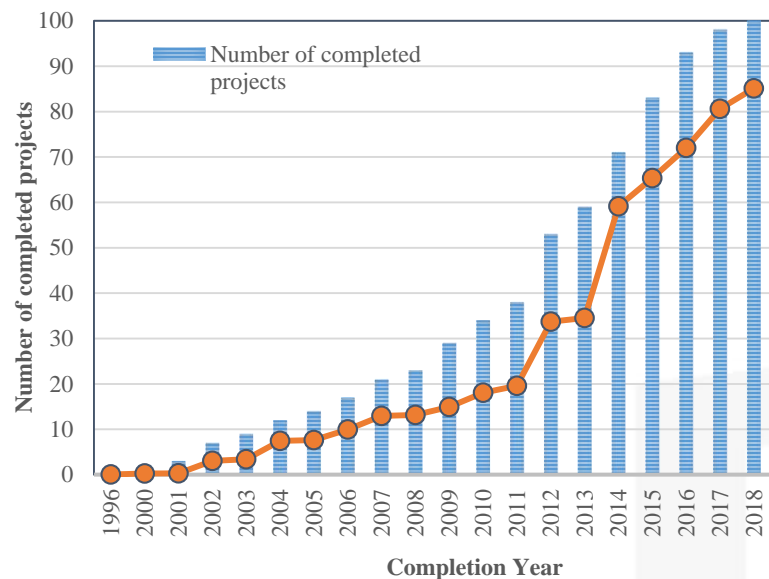
**Scott Bucking**  
 S2K Technology  
 Net-Zero Energy "Silverhead", London, Ontario



# APEC Program--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## General Information of NZEB Best Practices Investigation

### TECHNICAL ANALYSIS

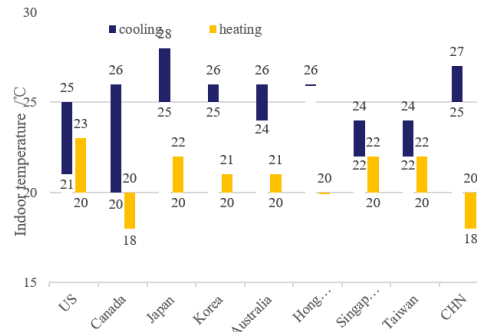


# APEC Program--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## Indoor environment quality (IEQ) in NZEB

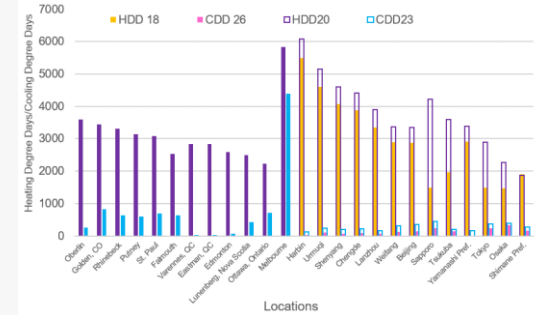


Indoor temperature setting



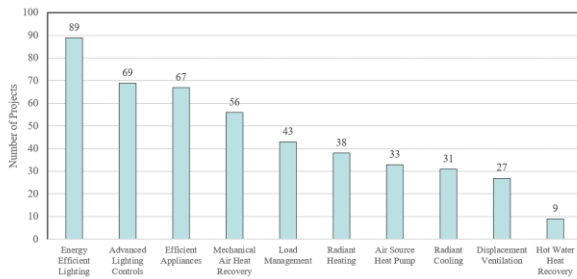
Indoor relative humidity

## TECHNICAL ANALYSIS

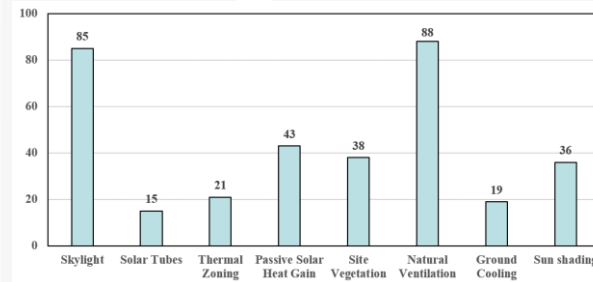


HDD and CDD of the projects locations

## Passive and Active approaches to NZEB



Passive Approaches to NZEB



Active Approaches to NZEB

# APEC Program--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## TECHNICAL ANALYSIS

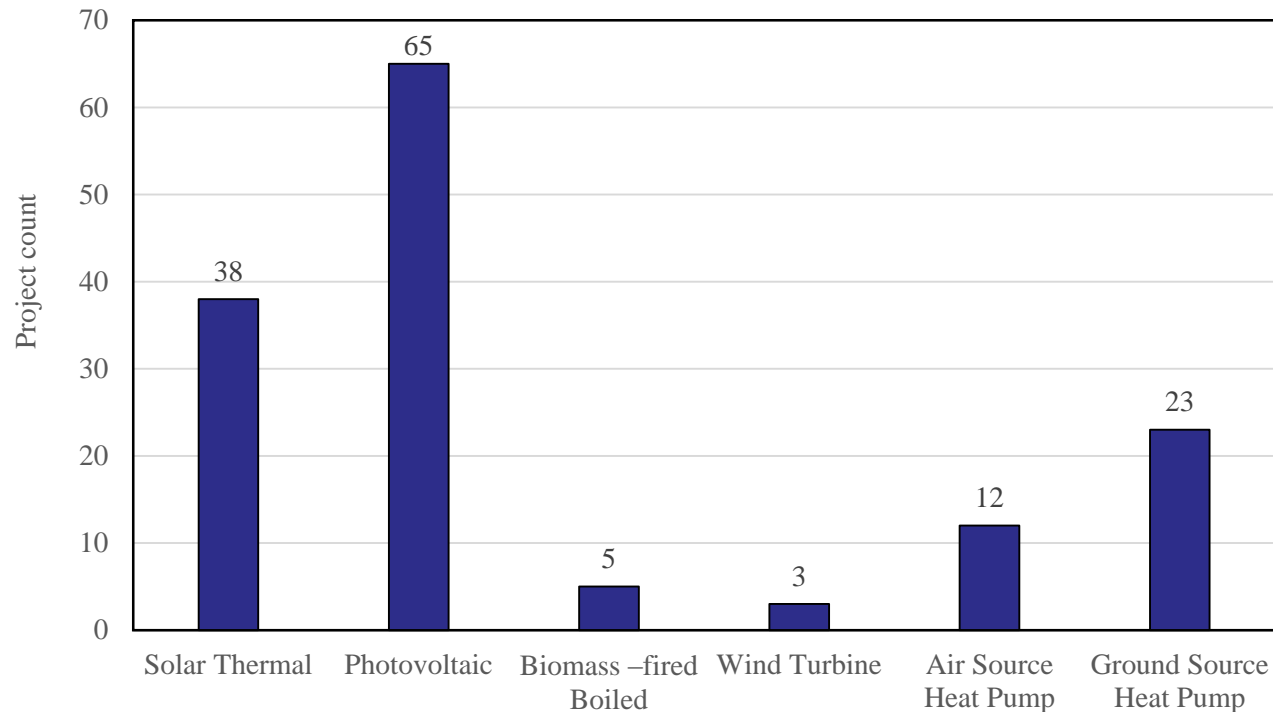
### Passive Approaches to NZEB

Passive Strategies	Heating	Cooling	Lighting
Air tightness	●	●	
Ground Cooling		●	
Natural Ventilation		●	
Passive Solar Heat Gain	●		●
Site Vegetation		●	●
Skylight			●
Solar Tubes			●
Sun shading		●	●
Super insulation	●	●	
Thermal mass	●	●	
Thermal Zoning	●		

# APEC Program--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## Renewable Applications in NZEB

### TECHNICAL ANALYSIS

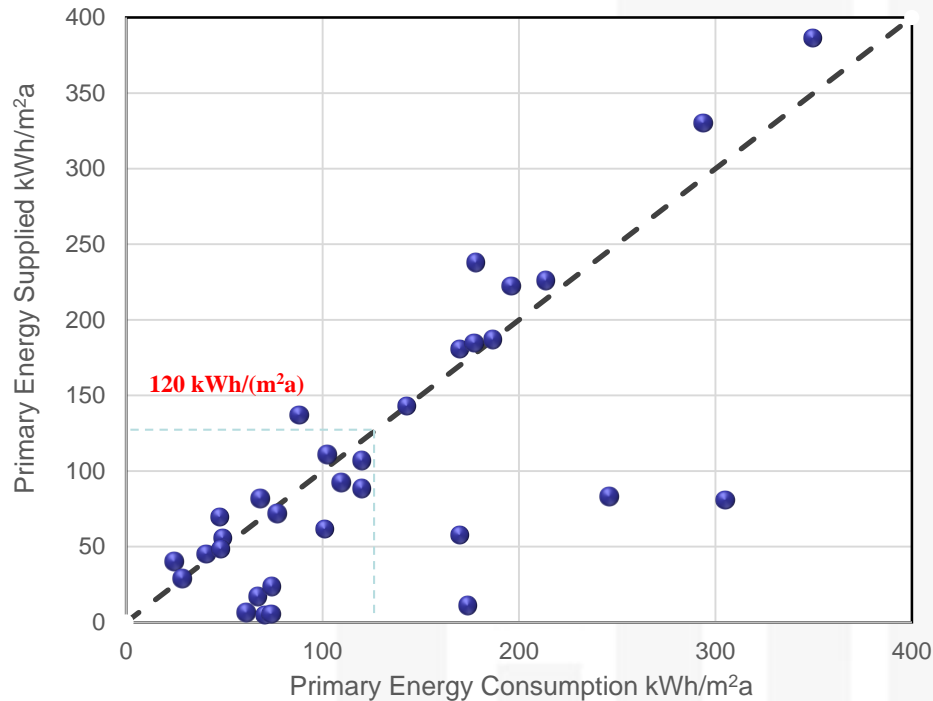


Renewable applications in NZEB

# APEC Program--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## General Information of NZEB Best Practices Investigation

### TECHNICAL ANALYSIS



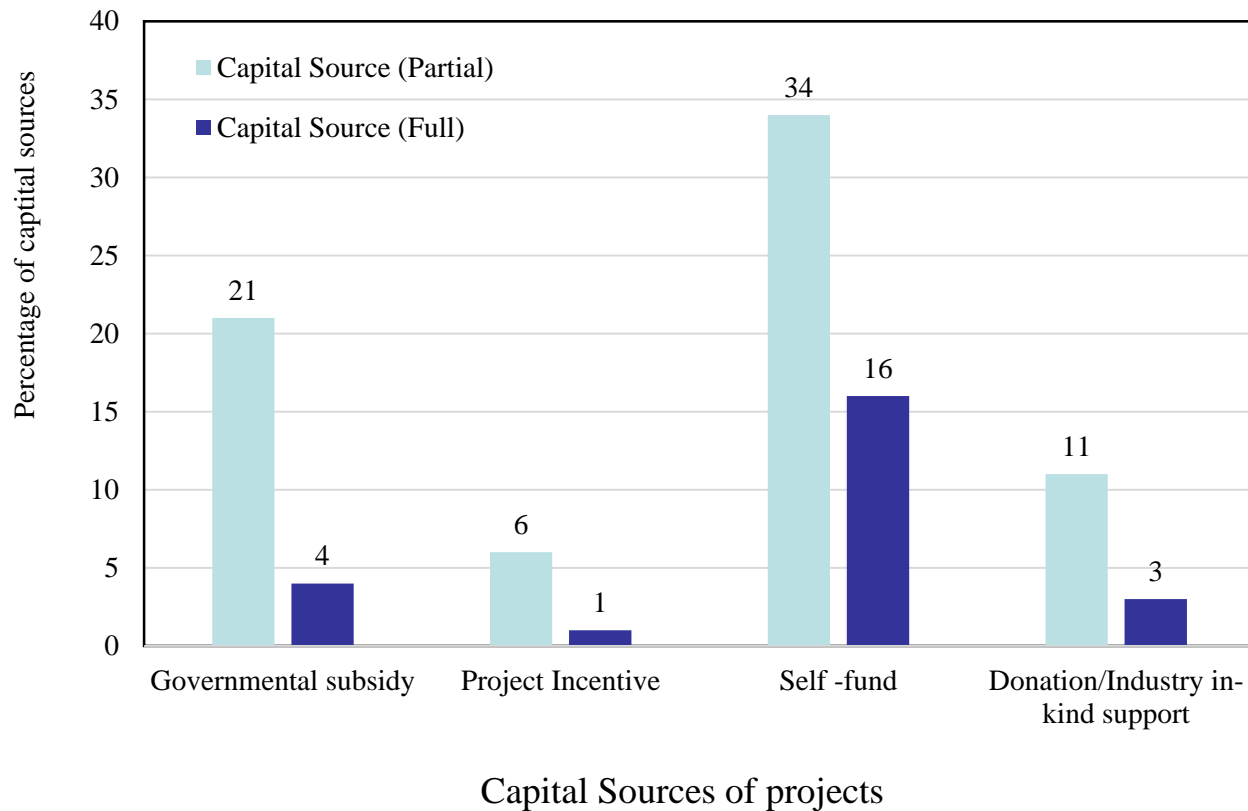
- Heating and cooling
- Lighting
- Plug

Energy balance chart for Net Zero Energy Buildings

# APEC Program--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

## TECHNICAL ANALYSIS

### Economic analysis of NZEB





## EWG 15 2016A

# APEC Nearly (Net) Zero Energy Building Roadmap Study responding to COP21

## WORK PLAN

### (1) September 2017 –workshop in Hawaii

● **a flexible, measured approach** to reducing building energy consumption throughout APEC regions, cover all the technical priority to achieve NZEB in all APEC climate zones.

● **A more clear technology roadmap** to achieve NZEB that covers different climate zones, thus to respond to COP 21 GOAL ( 2015 Paris Goal)

THE BUILDINGS SECTOR IS ACTING  
NOW IT IS TIME TO SCALE UP



# “EWG-15-2016A: APEC Nearly (Net) Zero Energy Building Roadmap Study responding to COP21

5<sup>th</sup> APEC NZEB Program meeting

September 2017- - - Honolulu !  
Welcome. Aloha.



## APEC Nearly/Net Zero Energy Building Program

### 2018 Concept Note : APEC Net Zero Energy Building Initiative

Re: Leading businesses back 2050 net zero goal for buildings

ph15

发给 张时聪, 李鹏程

2017-02-19 16:00 隐藏信息

发件人: ph15 <ph15@apcc.org>

收件人: 张时聪 <zhangshicong01@126.com>

抄送: 李鹏程 <lipch@cnis.gov.cn>

时间: 2017年2月19日 (周日) 16:00

大小: 51 KB

Dear Shicong

Such an APEC Net-zero Building Initiative idea could indeed be a next step and sounds interesting for members to explore together. With Pengcheng's support you could propose that EGEEC work on what sorts of goal(s) could be included (including possible voluntary non-binding target(s)), how the current baseline and progress could be measured (possibly in cooperation with EGEDA or an international organisation already collecting building efficiency data in APEC economies), and what work could happen between members through APEC to contribute towards achievement of a goal. Also think about external partners to support activities through technical (or even funding) resources.

Such an initiative could be developed in consultation with other interested APEC members (Australia also has its project on buildings energy efficiency focussing on supporting Indonesia and other APEC members so it would be worth consulting with them both). There's also a China project in EGNRET working on solar powered buildings.

## APEC Nearly/Net Zero Energy Building Program

### 2018 Concept Note : **APEC Net Zero Energy Building Initiative**

I encourage you to work with members to raise the level of ambition and explore what could be possible as an APEC wide approach (possibly as a Pathfinder approach). You/Pengcheng may also want to consult early with the Lead Shepherd to get his guidance too, if you would like to pursue.

Best wishes

Penelope Howarth  
Director (Program)  
APEC Secretariat

# Thank you

**Contact:**

**Mr ZHANG SHICONG**

**Institute of Building Environment and Energy**

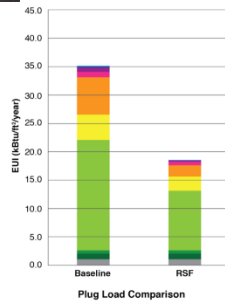
**China Academy of Building Research**

**86-10-84270181**

**zhangshicong01@126.com**

# APEC Program--Nearly (Net) Zero Energy Building PILOT BUILDINGS

## -USA- National Renewable Energy Laboratory



- Coffee Kiosk
- Elevator Lighting
- Elevators
- Breakroom
- Office Equipment
- Computers
- Data Center
- Conference Room Equipment
- Telecom Room Equipment
- Miss

## Korea -Zero Carbon Green Home



## China Academy of Building Research Nearly Zero Energy Building

