中國建築科學研究院
China Academy of Building Research

April 11 2018

51th Meeting of APEC-EGEE&C

DC. United States of American

Asia-Pacific Economic Cooperation

EWG 15-2016A

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

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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 Updates**
- **"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

1st APEC-Net Zero Energy Building workshop

20 economies
21 speakers
80 participants

Beijing. China.

30-31,Oct,2013

2nd 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

3rd APEC-CZEBS iiSBE Smart Net Zero Resilient Buildings and Communities Net Zero Built Environment Symposium

21 economies
35 speakers
130 participants

Aug 2015 Montreal

4th APEC workshop on Nearly/net zero energy building– From best practices to mass market Built Environment Symposium

11 economies
8 speakers
35 participants

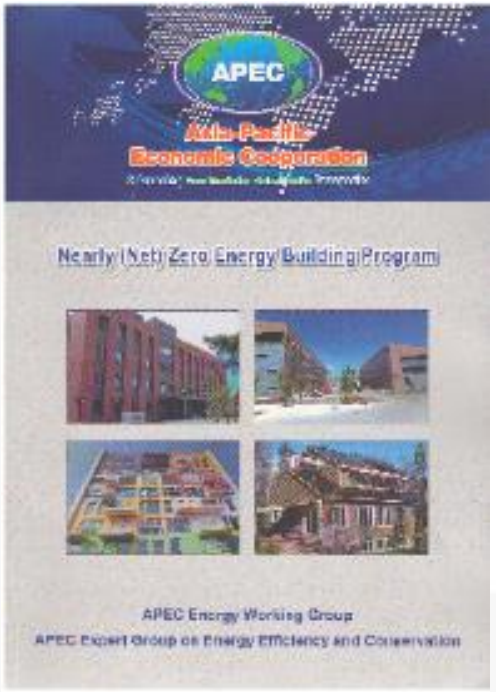
April 2016 Taichung

FINAL REPORT

APEC Program--Nearly (Net) Zero Energy Building

Focus Area:

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



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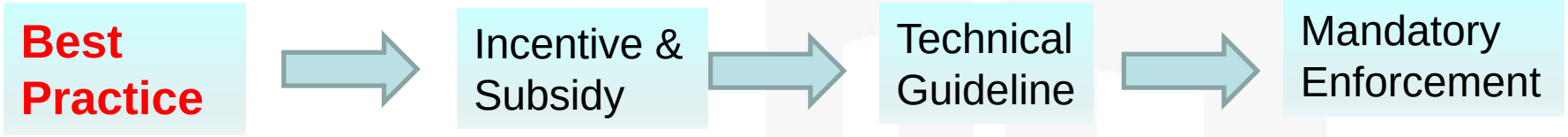
Download address: http://publications.apec.org/publication-detail.php?pub_id=1595

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



Focus Area:

- Comprehensive and systematic information collecting template on existing NZEB pilot & demonstration best practice 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

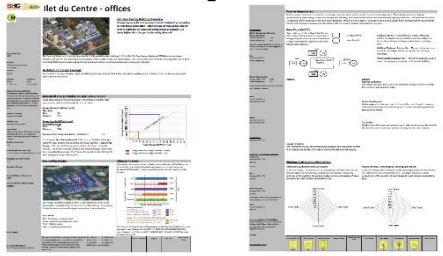
Dr Wei Feng
Lawrence Berkeley National Laboratory

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

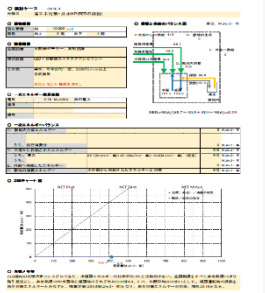
BEST PRACTICES TEMPLATE DESIGN

Support materials for NZEB best practices template design

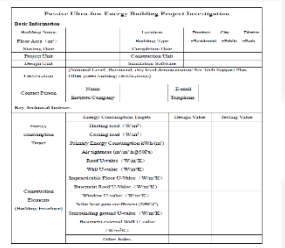
(1) IEA Joint SHC Task 40 Building information template

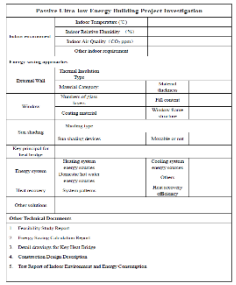


(2) Japan NZEB template



(3) China Passive building projects investigation

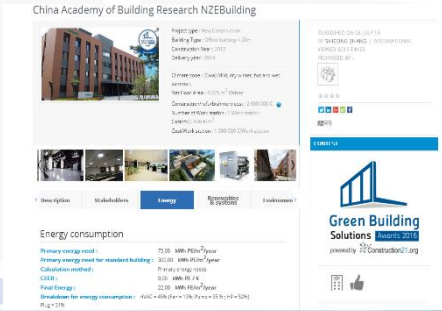




（4）The United States DOE NREL building database

（4）ENOB energy-optimized construction database

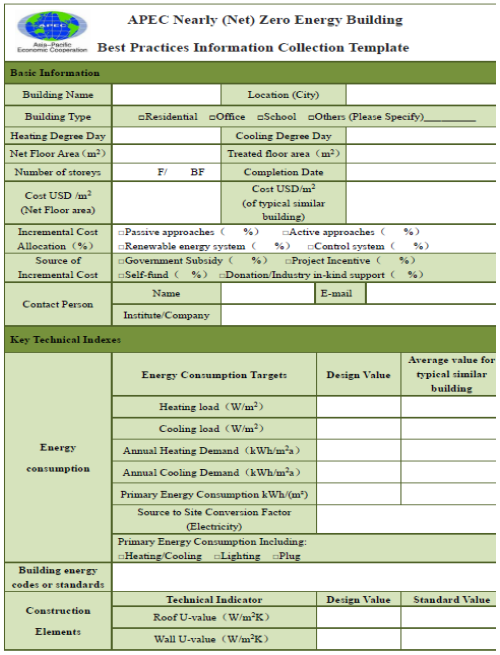
（5）Construction 21 building database



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

BEST PRACTICES TEMPLATE DESIGN

APEC NZEB best practices template design



APEC Nearly (Net) Zero Energy Building

Best Practices Information Collection Template

Basic Information			
Building Name		Location (City)	
Building Type	□Residential □Office □School □Others (Please Specify)_____		
Heating Degree Day		Cooling Degree Day	
Net Floor Area (m^2)		Treated floor area (m^2)	
Number of storeys	F/ BF	Completion Date	
Cost USD /m^2 (Net Floor area)		Cost USD/m^2 (of typical similar building)	
Incremental Cost Allocation (%)	□Passive approaches (%) □Active approaches (%) □Renewable energy system (%) □Control system (%)		
Source of Incremental Cost	□Government Subsidy (%) □Project Incentive (%) □Self-fund (%) □Donation/Industry in-kind support (%)		
Contact Person	Name	E-mail	
	Institute/Company		

Key Technical Indexes			
Energy consumption	Energy Consumption Targets	Design Value	Average value for typical similar building
	Heating load (W/m^2)		
	Cooling load (W/m^2)		
	Annual Heating Demand (kWh/m^2a)		
	Annual Cooling Demand (kWh/m^2a)		
	Primary Energy Consumption kWh/(m^2)		
	Source to Site Conversion Factor (Electricity)		
	Primary Energy Consumption Including: □Heating/Cooling □Lighting □Plug		
Building energy codes or standards			
Construction Elements	Technical Indicator	Design Value	Standard Value
	Roof U-value (W/m^2K)		
	Wall U-value (W/m^2K)		

1

(Building Envelope)	Window U-value (W/m^2K)		
	Solar heat gain coefficient (SHGC)		
	Air tightness (m^3/m^2h@50Pa)		
Renewable Energy	Energy Category	Main Parameters	
	Solar Thermal		
	Photovoltaic		
	Biomass –fired Boiled		
	CHP		
	Wind Turbine		
	Air Source Heat Pump		
	Ground Source Heat Pump		
	Total Energy Supply kWh/m^2		
Indoor environment	Indoor Temperature (℃)		
	Indoor Relative Humidity (%)		
	Indoor Air Quality (CO_2 ppm)		

Energy saving approaches (Yes for √)				
Passive Approaches	Skylight	Solar Tubes	Thermal Zoning	Passive Solar Heat Gain
	Site Vegetation	Natural Ventilation	Ground Cooling	Sun shading
	Others (Please Specify)			
Active Approaches	Energy Efficient Lighting	Advanced Lighting Controls	Efficient Appliances	Load Management	Mechanical Air Heat Recovery
	Displacement Ventilation	Radiant Heating	Radiant Cooling	Air Source Heat Pump	Hot Water Heat Recovery
	Other (Please Specify)				

2

The template have been sent to:

18 experts over 8 economies:

100 feedbacks were chosen to contribute the final report.

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

BEST PRACTICES INVESTIGATION

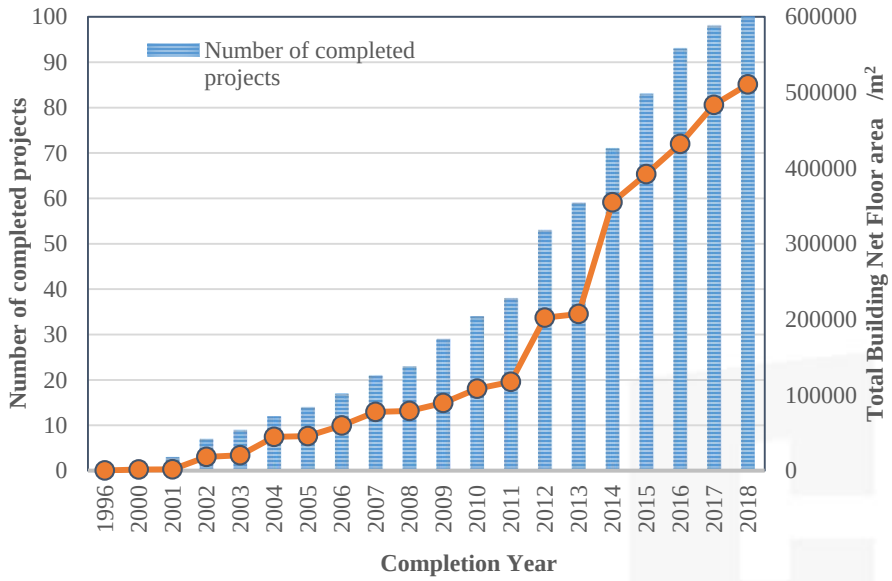
Participants from 9 APEC economies responded to the survey

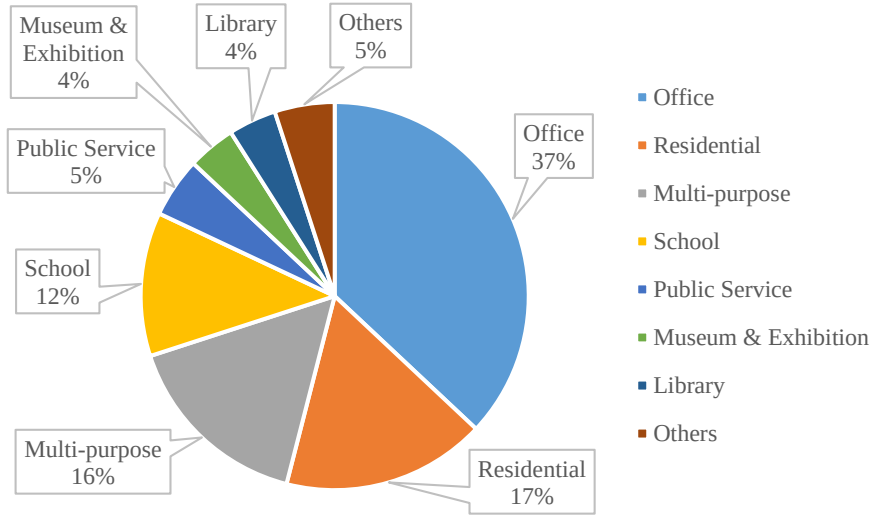
APEC economies with VFEL	Survey	Number of best practices that investigated	Number of best practices that are disclosed
Australia	√	2	2
Canada	√	7	7
China	√	34	34
Hong Kong, China	√	1	1
Japan	√	20	6
Republic of Korea	√	10	10
Singapore	√	1	1
US	√	24	22
Chinese Taipei	√	1	1

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

TECHNICAL ANALYSIS

General Information of NZEB Best Practices Investigation



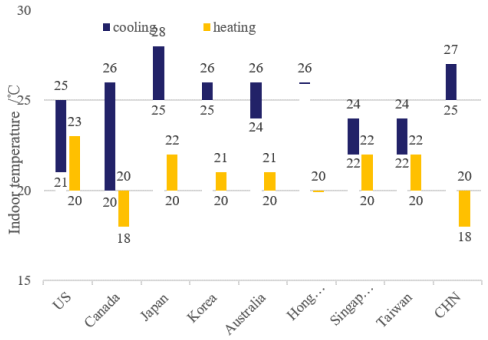


APEC Program--APEC NZEB Best Practices and Energy Reduction Results Comparative Study

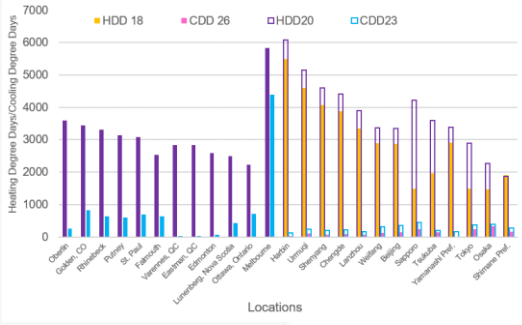
TECHNICAL ANALYSIS

Indoor environment quality (IEQ) in NZEB

Indoor temperature setting

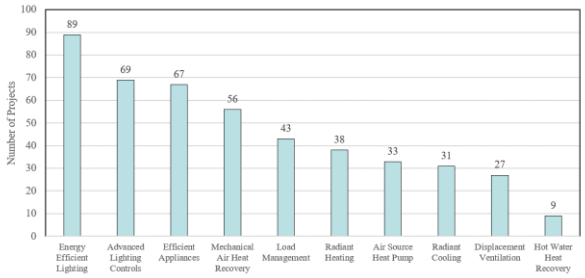


Indoor relative humidity

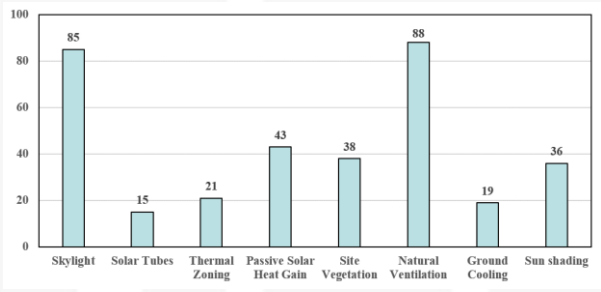


HDD and CDD of the projects locations

Passive and Active approaches to NZEB



Passive Approaches to NZEB



Active Approaches to NZEB

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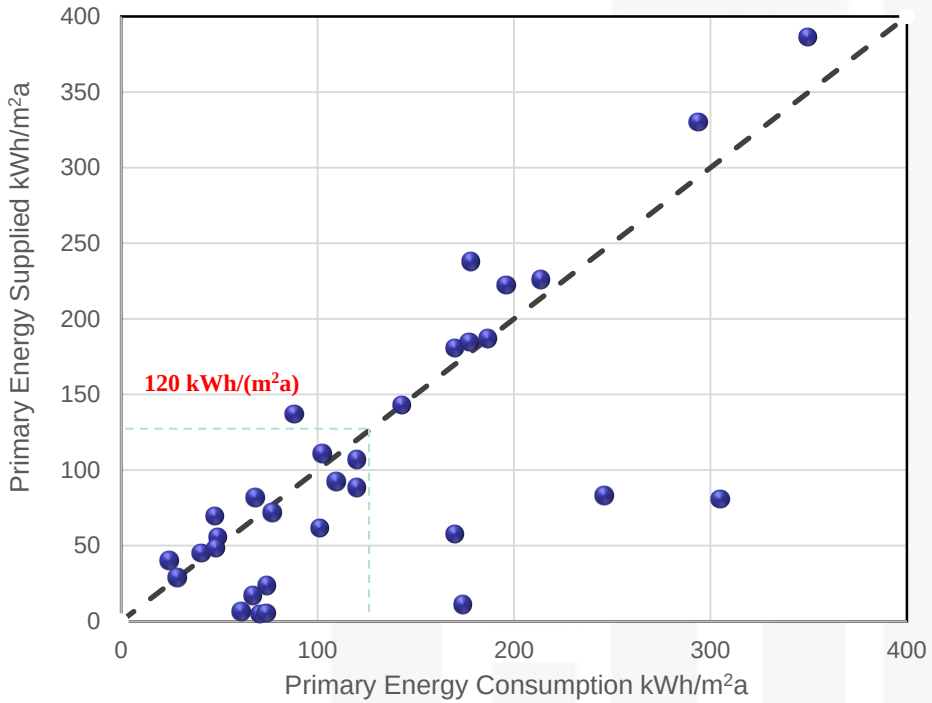
TECHNICAL ANALYSIS

General Information of NZEB Best Practices Investigation



Energy balance chart for Net Zero Energy Buildings

- **Heating and cooling**
- **Lighting**
- **Plug**

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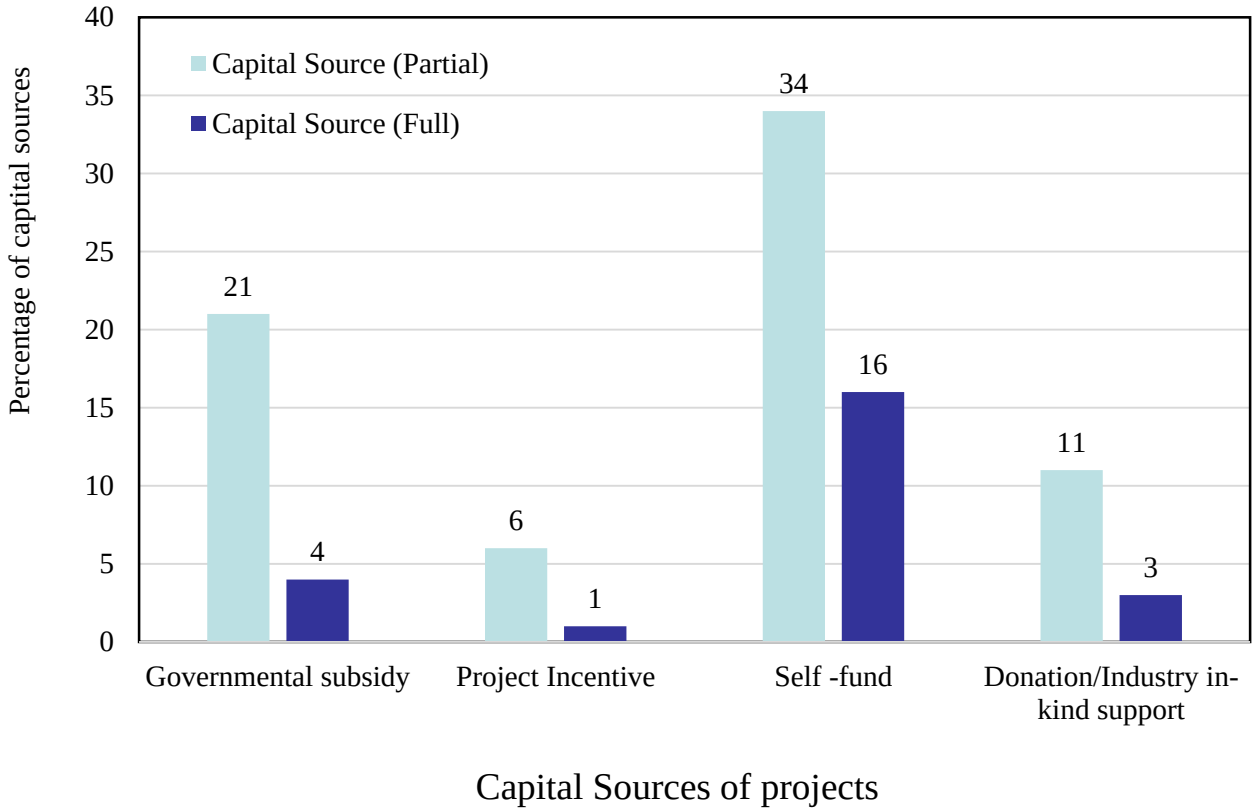
TECHNICAL ANALYSIS

Economic analysis of NZEB



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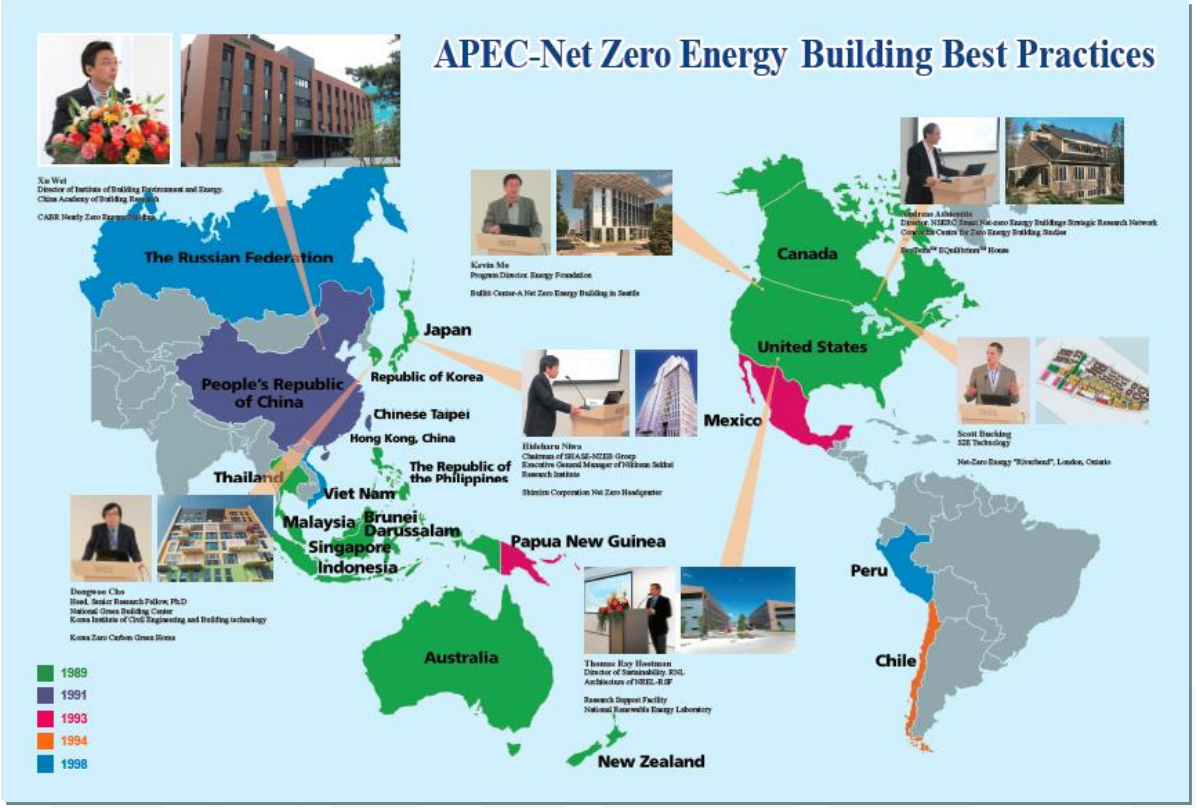

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Download address: https://www.apec.org/Publications/2017/05/APEC-100-Best-Practice-Analysis-of-NearlyNet-Zero-Energy-Building

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

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

- **Mid – Long term goal suggestion** on building sector, especially for Nearly/Net Zero Energy Building.
- **What kind of policies could be considered to promote NZEB.**
- **A more clear technology roadmap to achieve NZEB** that covers different climate zones, thus to respond to COP 21 GOAL (2015 Paris Goal)

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

- A 3 days workshop, Workshop of APEC Nearly /Net Zero Energy Building Roadmap responding to COP21, was very well implemented, with 37 experts from 11 economies and also together with 4 NGOs, which are Asia Pacific Energy Research Centre, Paulson Institute, World Green Building Council and Energy Foundation, on 4-6 September 2017.
- 8 speakers and 6 attendees were female.

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

Next Step:

- May. Draft Report for group review.
- June to September. Keep revising.
- Before 52th EGEEC meeting. Submit the report to EGEEC.
- End of November. Close the project

Thank you

Contact:

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Institute of Building Environment and Energy

China Academy of Building Research

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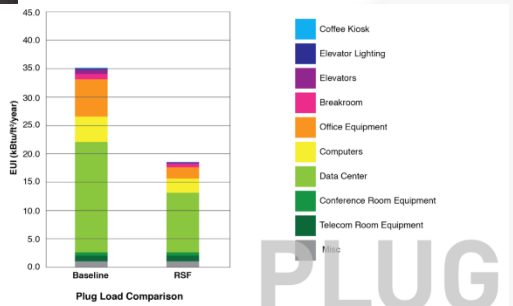
zhangshicong01@126.com

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

–USA- National Renewable Energy Laboratory



Korea –Zero Carbon Green Home

China Academy of Building Research Nearly Zero Energy Building

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

TECHNICAL ANALYSIS

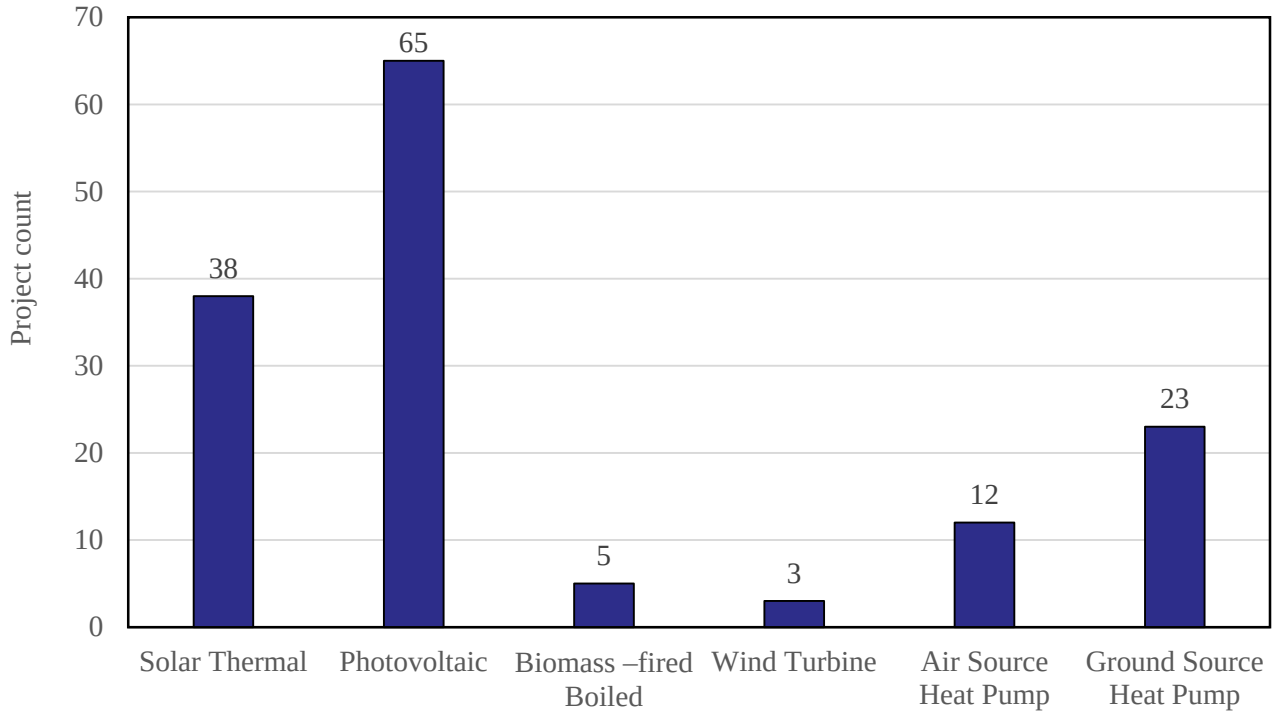
Passive Approaches to NZEB

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