



EWG 01/2009T

Reducing barriers to trade through development of a common protocol for measuring the seasonal energy efficiency (SEER) of air conditioners

Chinese Taipei



Objective of the project

The objective of this project aims to **develop an analytical platform to evaluate the SEER values** for room air conditioner (RACs) of APEC economies.

This objective will be met **based on the data of climate and building load characteristic collected from APEC economies.**

With the application of this program, it will help to reduce unnecessary duplicate test and administration process. Meanwhile, it also helps to reduce the cost and times of testing, and further affect the efficiency of trading among APEC economies.

Budget

The total approved budget for this study is **US\$60,000** from APEC funding. The consultant will prepare an itemized budget (up to **US\$41,200**) and submit this with a proposal.



Progress

- **Complete set up the Steering Committee, planning of timetable and Request for Proposal (RFP). Currently in the progress of seeking for contractor, the contract between APEC secretariat and contractor is expected to be complete at the end of April.**
- **Proposals should be submitted to project overseer before Closing Time and Date: 5:00pm, Thursday, 30th April 2009 (Singapore Time).**
- **The RFP information had been posted on 8 April 2009 on APEC website.**



Scope of Work

- 1. Collect the weather data and the building load curve of the regions concerned.**
- 2. Develop a common code for performing Seasonal Energy Efficiency Ratio (SEER) of room air conditioners (RACs).**
- 3. Design and deliver one and a half days open workshop at Chinese Taipei on topic of air conditioning SEER to those experts or representatives mainly from APEC economies.**
- 4. Publish (consistent with APEC publication policy) and distribute 3 electronic copies of the outcome of workshop to workshop participants and others APEC Economies member.**
- 5. Provide an electronic copy of the above publications and the outcome of the development of SEER program to the APEC Secretariat for dissemination via the APEC Website.**



Timetable & Deliverables for tenders

Activities	Dates
Deadline for submission of proposals to the Project Overseer;	30 April 2009
Proposal evaluation and bid selection by Steering Committee of representatives from APEC Member Economies;	1-6 May 2009
Negotiation of contract details between the APEC Secretariat and the successful tender;	7-15 May 2009
Organization of workshop and invitation of speakers sent	17 July 2009
Stage 1	10 July 2009
<ul style="list-style-type: none"> •Planning overall SEER development structure •Collection of related APEC economies weather data, consumer's behavior of using air conditioner, building load characteristic and the existing regulation and standards 	
Finalized the details of workshop and complete lists of experts and participants	
Stage 2	25 September 2009
•Completion initial version of SEER program	
Execution of Workshop;	
Publish and distribute the outcome of workshop to participants and APEC Economies.	7-8 October 2009
	23 October 2009
Stage 3	20 November 2009
•Complete the final version of SEER program with verified result	
Collection result of workshop, SEER testing method and program	4 December 2009
Produce an electronic version of the above document for dissemination via the relevant APEC Websites.	11 December 2009



Key parameters for SEER calculation

1. Air conditioner testing requirement, cooling capacity and consumer's behavior□

According to the standards and specification of various regions.

2. Degradation Coefficient (C_D)□

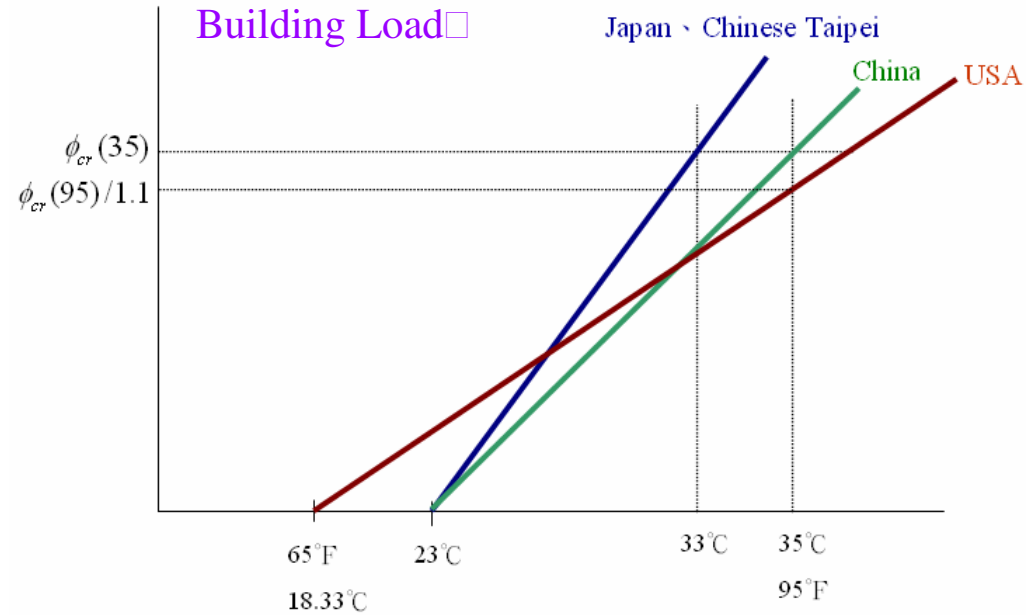
When the air conditioner is in on-off cycle state, the degradation coefficient is needed to be included in calculation.

The United States proposed to use $C_D = 0.2$ □Japan, China, and Chinese Taipei used $C_D = 0.25$.



3. Building load curve (BL) □

Usually is a straight line, and the outdoor temperature is as the horizontal axis. The intersection between air conditioner cooling capacity and building load curve can be used to decide the operation mode of the air conditioner, i.e. on-off cycle state, continuous operation mode or variable speed operation mode.



Where ϕ_{cr} is the cooling capacity of the air conditioner.

	Unites States	Japan	China	Chinese Taipei
Standards	ASHARE 116-1995	JRA 4046 : 2004 JIS C 9612 : 2005	GB/T 7725-2004 Appendix E	CNS 14464
Definition Method	BL(65°F)=0 BL(95°F)=Cooling capacity / 1.1	BL(23°C)=0 BL(33°C)=Cooling Capacity	BL(23°C)=0 BL(35°C)=Cooling Capacity	BL(23°C)=0 BL(33°C)=Cooling Capacity



4. Meteorological statistics

Data of the whole year's average outdoor temperature of the region.

Following is an example.

Economies Member <input type="checkbox"/>		Chinese Taipei	
Contact (email) <input type="checkbox"/>		HsiaoChiHsu@itri.org.tw	
Outdoor Temperature (<input type="checkbox"/>)	Time (hour)	Outdoor Temperature (<input type="checkbox"/>)	Time (hour)
21	0	31	326
22	0	32	233
23	0	33	112
24	587	34	37
25	700	35	12
26	760	36	4
27	723	37	1
28	650	38	0
29	548	39	0
30	414	40	0



Calculation of SEER for a constant speed AC

Power consuming (Wh)

Section 1 : (on-off cycle)

$$P_c(t_j) = \frac{CLF(t_j) \cdot \dot{P}_c(t_j) \cdot n_j}{PLF(t_j)}$$

Section 2 : (continuous)

$$P_c(t_j) = \dot{P}_c(t_j) \cdot n_j$$

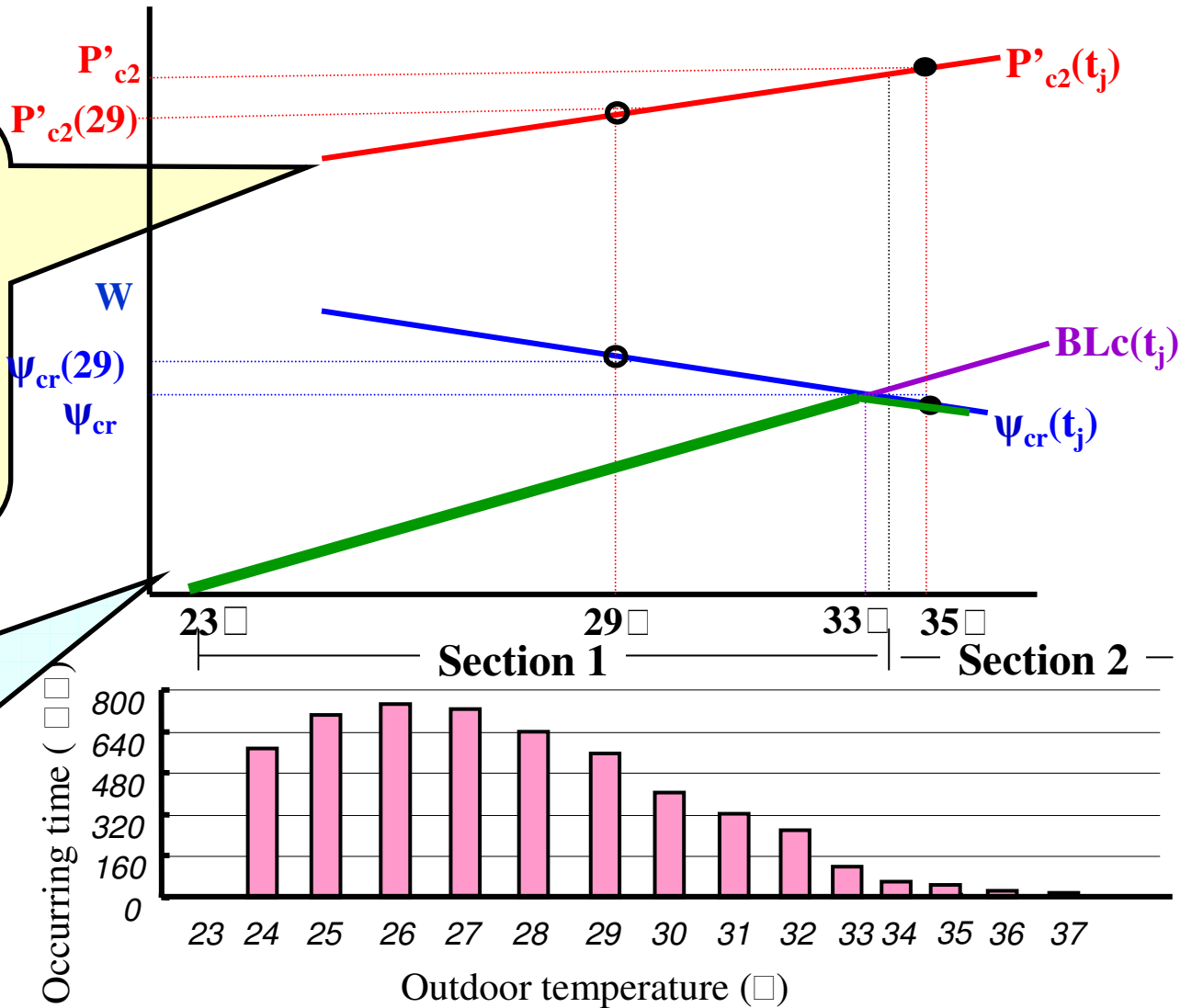
Cooling load (Wh)

Section 1 :

$$\Phi_{cr}(t_j) = BL_c(t_j) \cdot n_j$$

Section 2 :

$$\Phi_{cr}(t_j) = \phi_{cr}(t_j) \cdot n_j$$





Calculation of SEER for a variable speed AC

Power consuming (Wh)

Section 1 : (on-off cycle)

$$P_{clm}(t_j) = \frac{BL_c(t_j)}{C_{clm}(t_j)} \times \frac{n_j}{PLF(t_j)}$$

Section 2 : (variable speed operation)

$$P_{cm2}(t_j) = \frac{BL_c(t_j)}{C_{cm2}(t_j)} \cdot n_j$$

Section 3 : (continuous operation)

$$P_c(t_j) = P_c(t_j) \cdot n_j$$

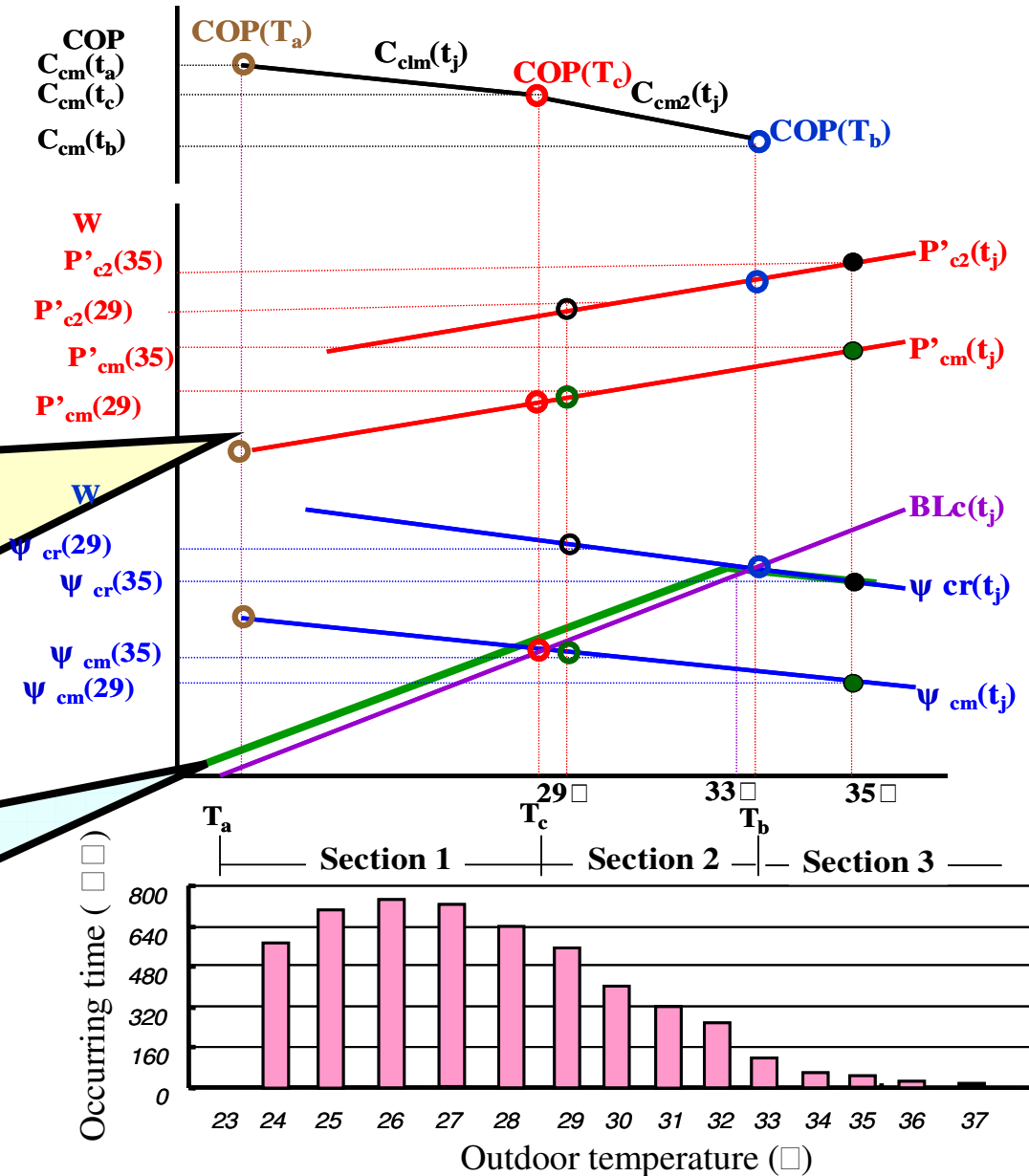
Cooling load (Wh)

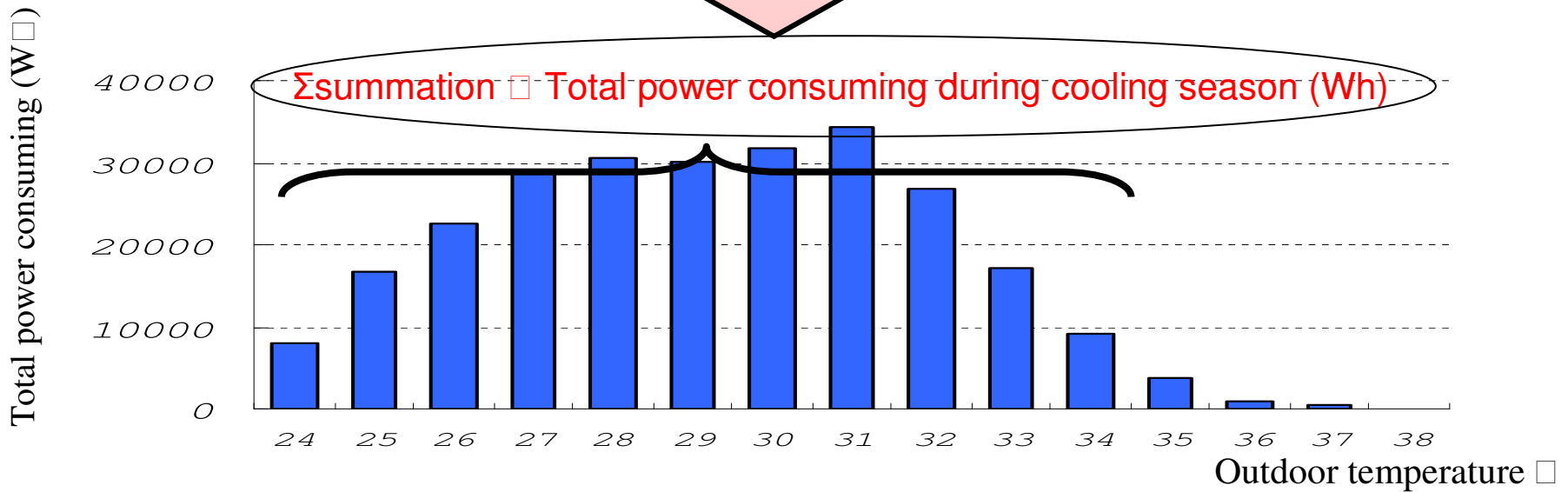
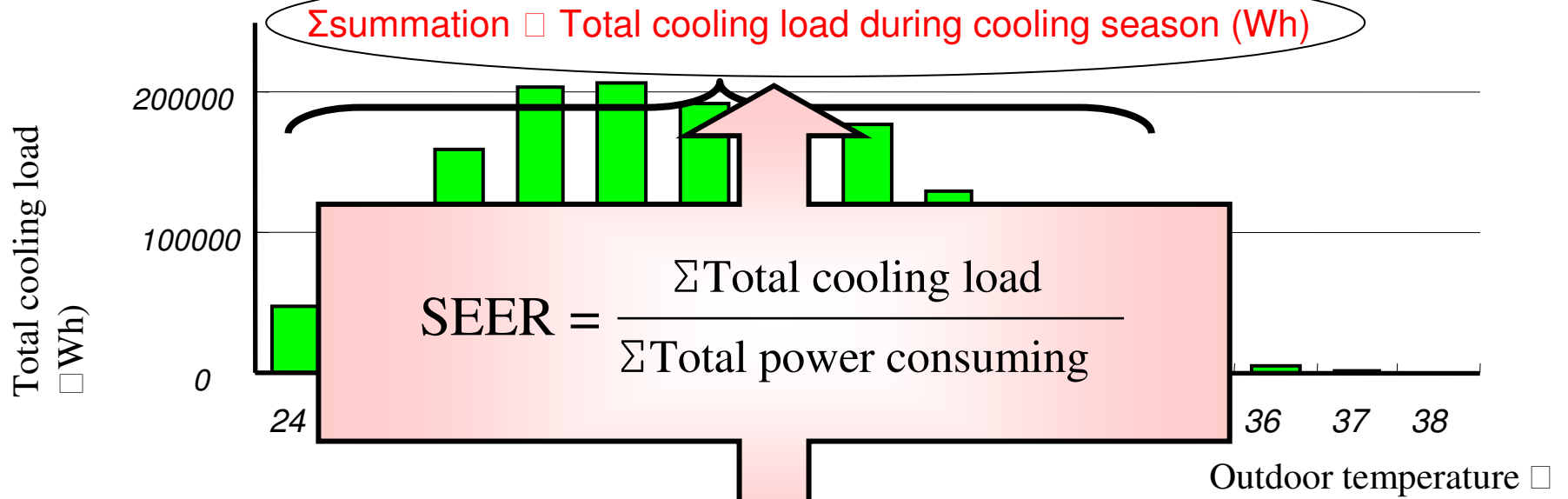
Section 1 & Section 2 :

$$\Phi_{cr}(t_j) = BL_c(t_j) \cdot n_j$$

Section 3:

$$\Phi_{cr}(t_j) = \phi_{cr}(t_j) \cdot n_j$$







Workshop for the Development of SEER

First day – Seminar (7th Oct., 2009 / Wed.)

Time	Topic	Speaker	
08:30 ~ 09:00	Registration		
09:00 ~ 09:30	Opening Ceremony		
09:30 ~ 10:30	Speech I		
10:30 ~ 10:50	Break		
10:50 ~ 12:00	Speech II		
12:00 ~ 13:30	Lunch Break		
13:30 ~ 14:50	Speech III		
14:50 ~ 15:10	Break		
15:10 ~ 16:30	Speech VI		
16:30 ~ 17:00	Discussion		
18:00 ~ 21:00	Welcome Dinner		

Second Day – Panel Discussion (8th Oct., 2009 / Thu.)

09:00 ~ 10:10	Speech V		
10:10 ~ 10:30	Break		
10:30 ~ 11:40	Speech VI		
11:40 ~ 12:00	Discussion		
12:00 ~ 13:30	Lunch		



Items seeking for the support from APEC economies

1. Economies please provide their respective country's
 - (1) **air conditioning testing standards**, if there is any
 - (2) **meteorological statistics**
 - (3) the recommended **Degradation Coefficient (C_D) value** and
 - (4) the proposed **definition of Building load curve's (BL)**.

The proposed format example of related information is

Economies Member	Chinese Taipei
Contact (email)	HsiaoChiHsu@itri.org.tw
Degradation Coefficient (C_D) <input type="checkbox"/>	0.25
Building load curve (BL) <input type="checkbox"/>	Outside Temperature ($^{\circ}\text{C}$)
BL = 0	23
BL = Cooling Capacity	33



2. A Workshop is planning and will be held on Oct. 7-8 in conjunction with 34th EGEE&C in Taipei.

Experts of SEER related field are welcomed to recommend as invited speakers from APEC economies.

Please send recommended experts, and provide the following information

Economies		Expert's name	
Service institution unit		Institution website	
Position (Title)		Email add.	
Tel		Fax	
Address			
Areas of expertise			



Thank you !!