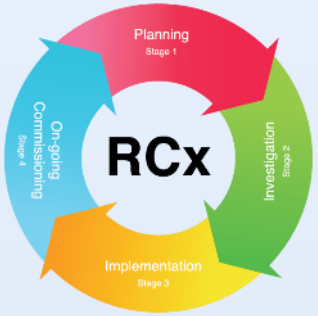
再调适绿色校园 2.0 – 专业讲座

机电工程署再调适(RCx)技术指引简介

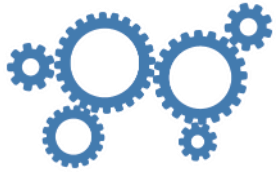
2020年12月2日

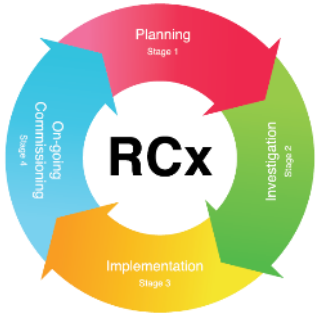


EMSD

大纲

1. 在香港的背景
2. 再调适的发展
3. 对再调适的支持





在香港的背景

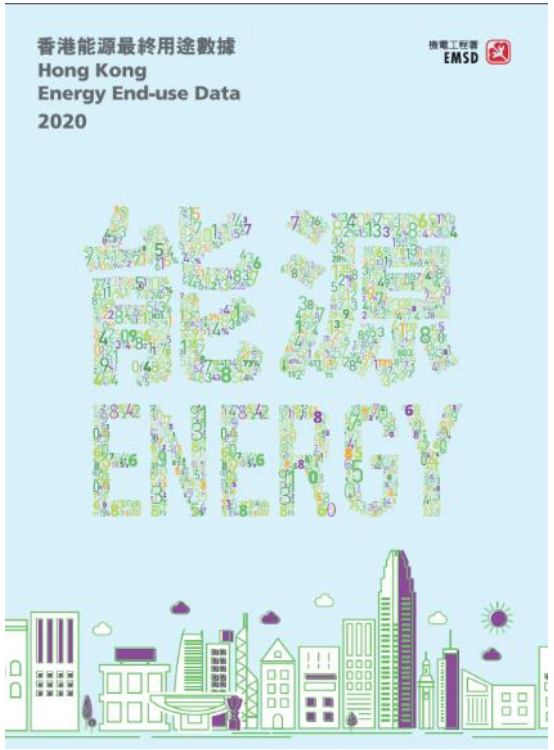
1

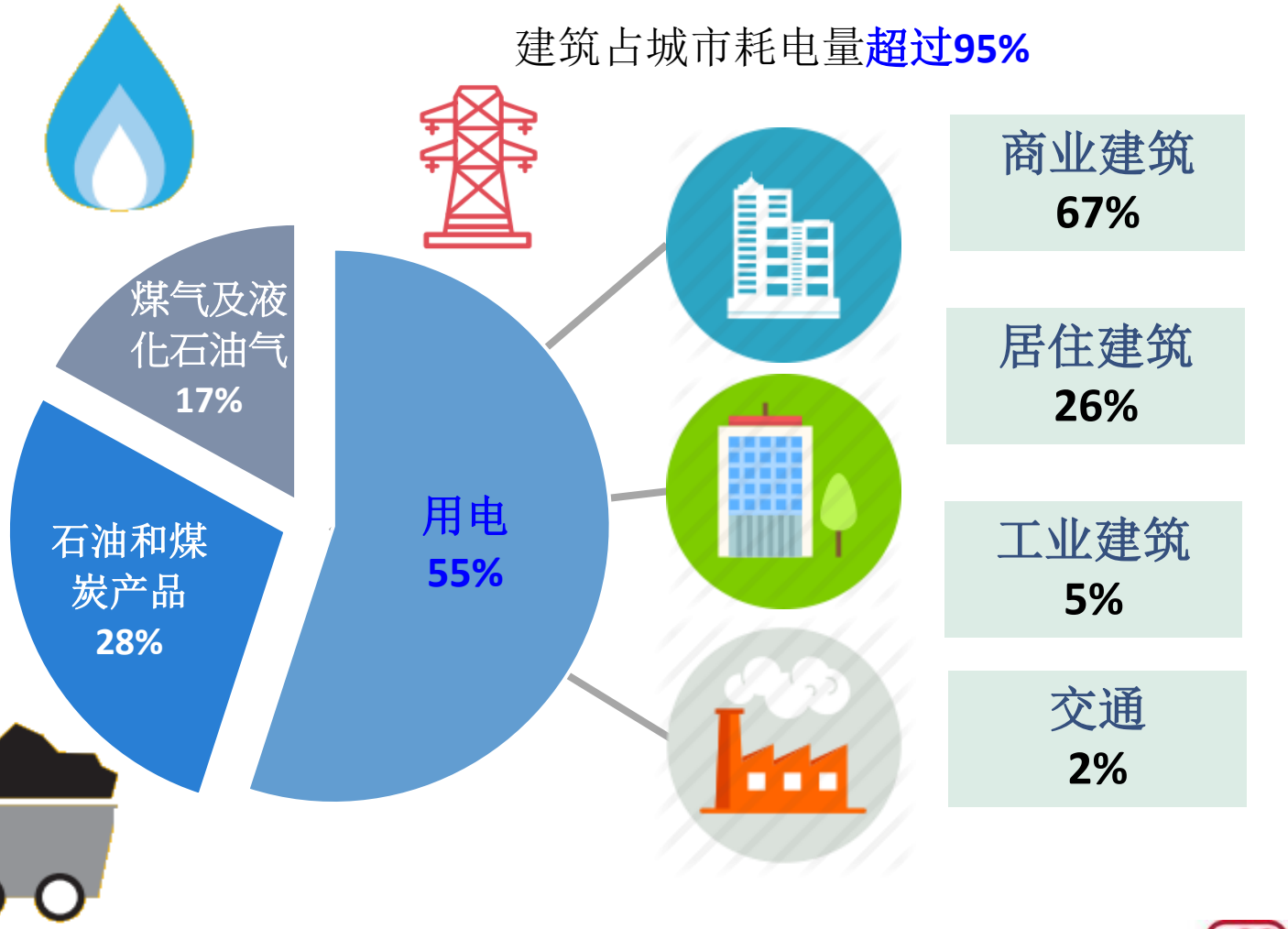
EMSD

香港能源消耗状况

人口
750万

政府 & 私人建筑
8000+ 42000+





建筑占城市耗电量**超过95%**

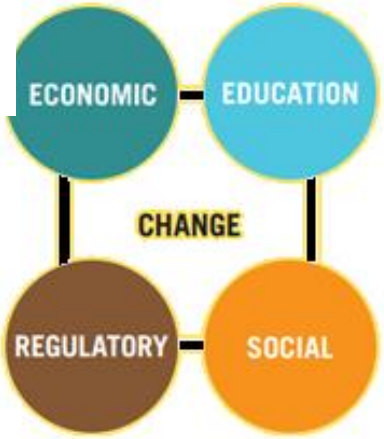
- 商业建筑 **67%**
- 居住建筑 **26%**
- 工业建筑 **5%**
- 交通 **2%**

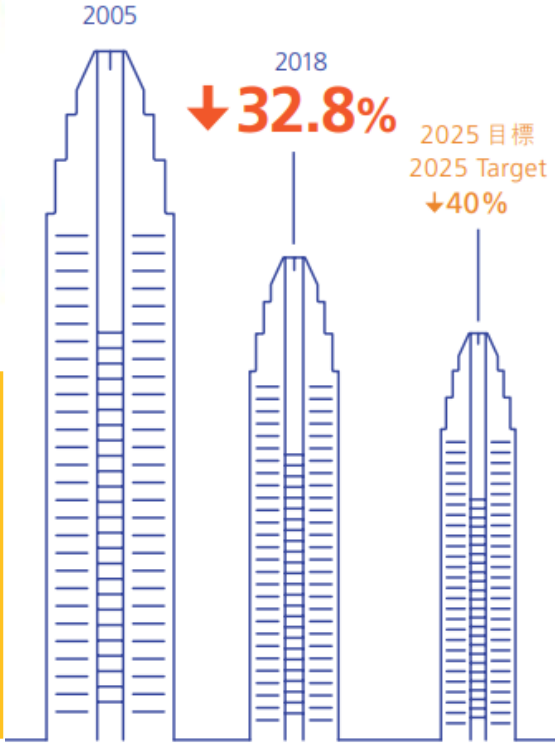
资料来源：Hong Kong Energy End-use Data 2020, EMSD
censtatd.gov.hk/hkstat/sub/so20.jsp

气候行动蓝图2030+ & 节能计划2015~2025

碳中和
从 2051 到 2100

政策

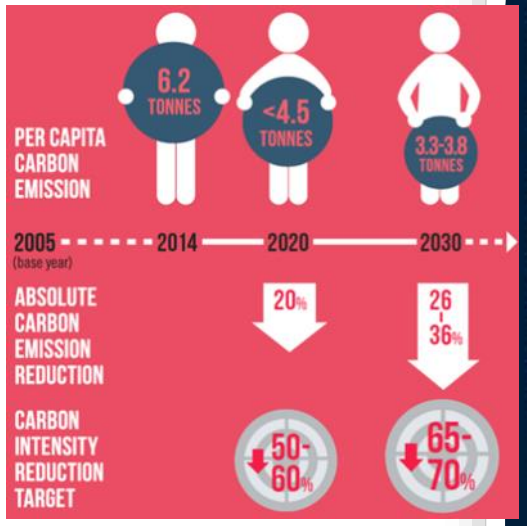




2020年施政报告– 迈向碳中和

碳排放
(以2005年为基准)

36%



碳中和

提高新建和现有建筑物的能源效益

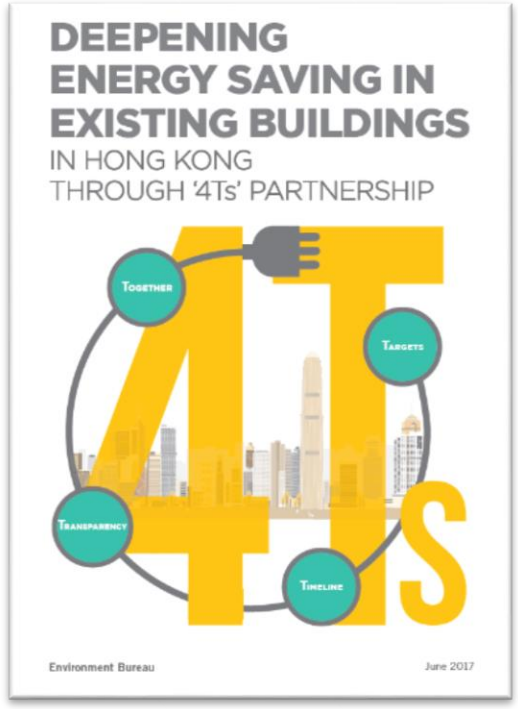
资料来源：https://www.enb.gov.hk/tc/sens-blog/blog20200421.html
2020 Policy Address
Climate Action Plan 2030+

4Ts 合作伙伴

4Ts 运行框架

3.所做的努力可以显示为适当的指标 -“开放透明”

2.制定与碳排放相关的减排 “时间表”



1.订立与碳排放相关的减排 “目标”

4.每个人都在 “共同参与”

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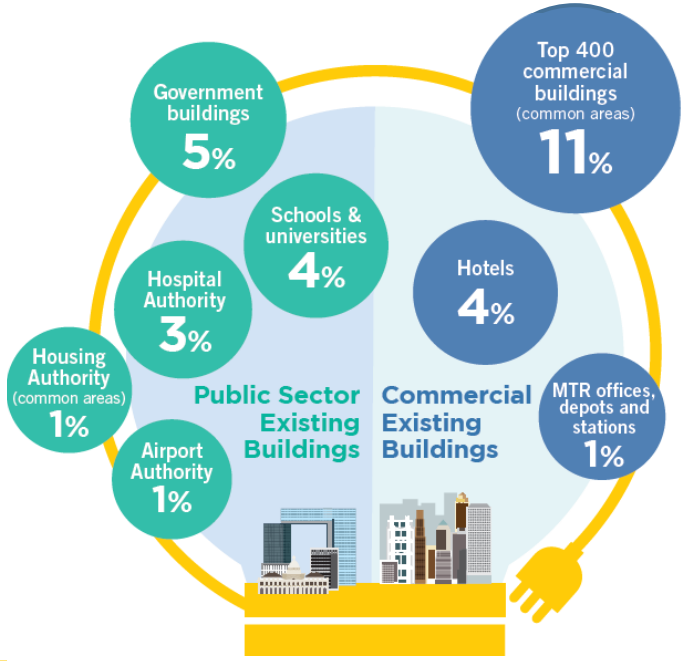
4Ts 合作伙伴

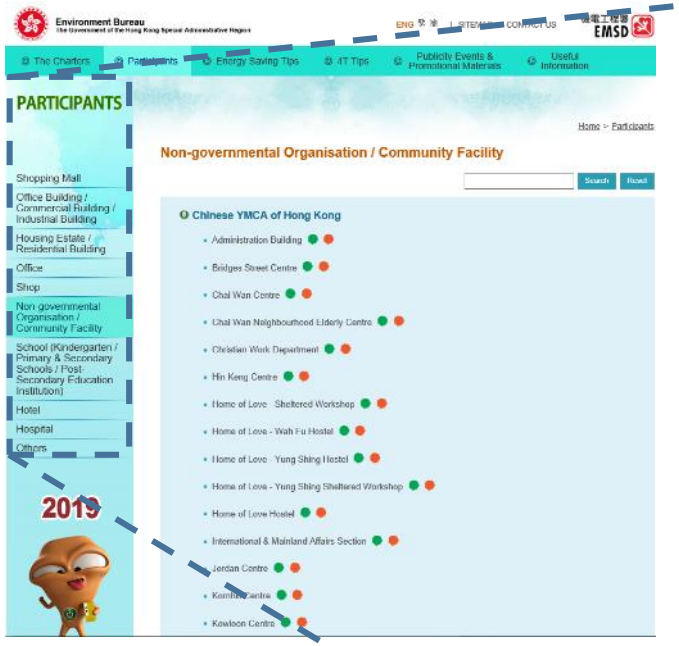
香港建筑中相关**能源优先**

Commercial & Institutional Buildings

1. Building design and structure
2. Occupants' behaviour
3. Appliances occupants choose to use

相当于香港 **20%** 的电力





PARTICIPANTS

- Shopping Mall
- Office Building / Commercial Building / Industrial Building
- Housing Estate / Residential Building
- Office
- Shop
- Non-governmental Organisation / Community Facility
- School (Kindergarten / Primary & Secondary Schools / Post-Secondary Education Institution)
- Hotel
- Hospital
- Others

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再调适的发展

2

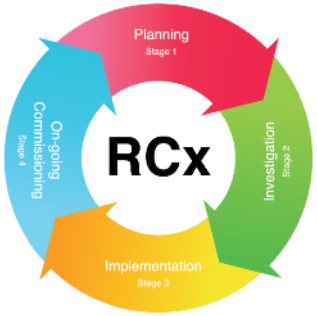
EMSD

我们为什么需要进行再调适?

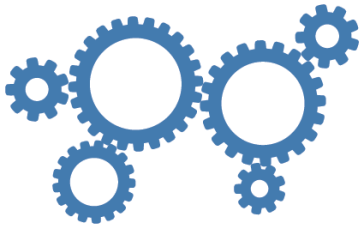
建筑物经常失调...

- 因增加、转换和改善工程而引起的变更
- 逐渐远离控制设定点
- 传感器的准确性或灵敏度下降，维护欠佳

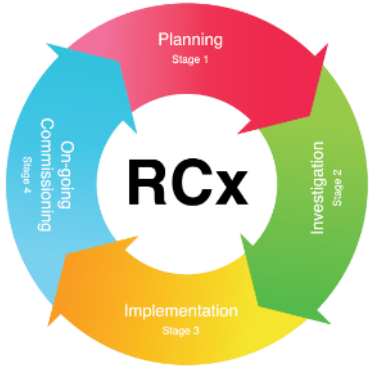
- 过时的控制系统
- 建筑表现不理想
- 不必要的能源损失



什么是再调适?



一个具有**成本效益**且**系统性**的过程，
可以定期检查现有建筑物的表现。



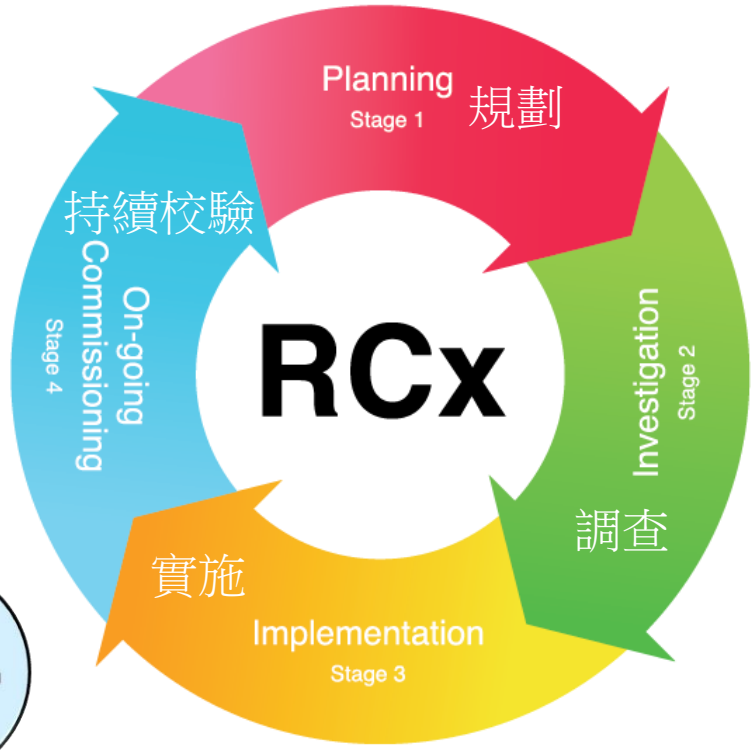
再调适工作阶段

阶段 1: 规划

阶段 2: 调查

阶段 3: 实施

阶段 4: 持续调适



再调适工作阶段

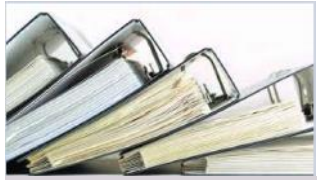
阶段 1: 规划

規劃 PLANNING

Workshop cum Seminar

4 Feb 2021 (Thu)

收集建筑物的设计和运行信息 → 达到设备要求 → **进行首次建筑物走查** → **收集耗能设备的能源信息** → 初步的节能机会 → 现场测量与数据确认计划



收集建筑信息

设备管理部会议

- 超过规定
- 不合理状况 [人体舒适]
- 检查仪表/传感器状况 [满足/故障]
- 检查控制设备功能 [故障]

- 运行时间表
- 检查运行范围
- 控制参数 & 设定点

现场走查 & 检查传感器状况

重新审核设备要求

Working Stages of RCx

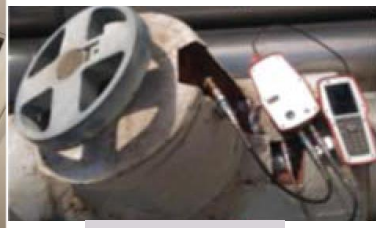
阶段 2: 调查

收集趋势记录数据和数据分析 → **识别潜在的节能计划(ESOs)** → 设定节能机会的测量和验证方式 → 选择实施的节能机会

- 添加仪表和数据记录设备
- 记录运行模式

- 检查不合理操作

当前记录仪



流量计

物联网传感器

2020年12月11日
（星期五）

2021年2月4日
（星期四）

再调适工作阶段

阶段 3: 实施

实施所选的节能机会

- 更换故障传感器和执行器
- 系统微调和调节
- 设备重新安排时间表
- 增加需求控制设备

执行测量和验证

制定最终报告和持续调适计划

- 确保高效的运行性能
- 追踪能源和系统性能
- 制定KPI并持续监控KPI
- 对运维人员进行培训

系统微调和调整

更换设备传感器

2021年2月4日
（星期四）

再调适工作阶段

阶段 4: 持续调适

报告改进 → **查看/更新运维手册** → **对运维人员进行培训** → **持续监控并修改运维计划以改善运行**

- 更新修正KPI
- 传感器校准
- 更新修正控制设定点

- 根据住宿和运行的变化更新相关信息

再调适的常规观察

示例 1: 物联网传感器的温度和相对湿度数据记录

全天异常的冷

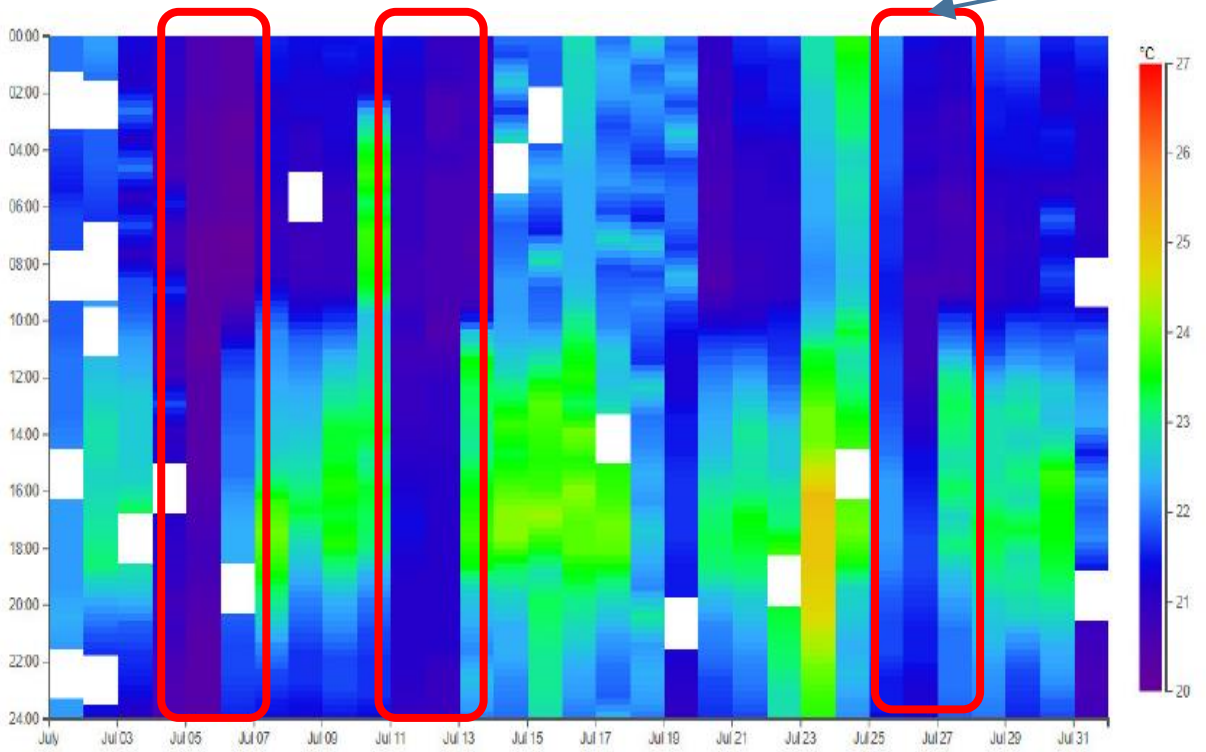


Figure. 1a Room Temperature in July

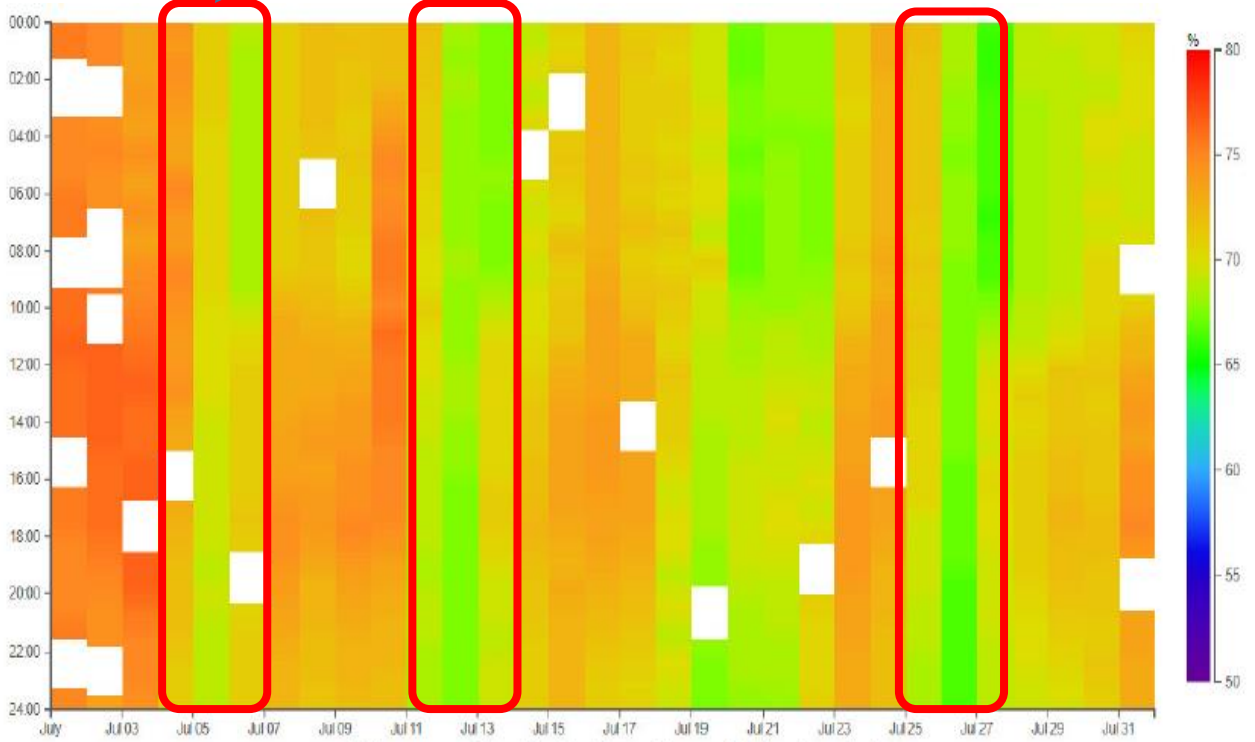
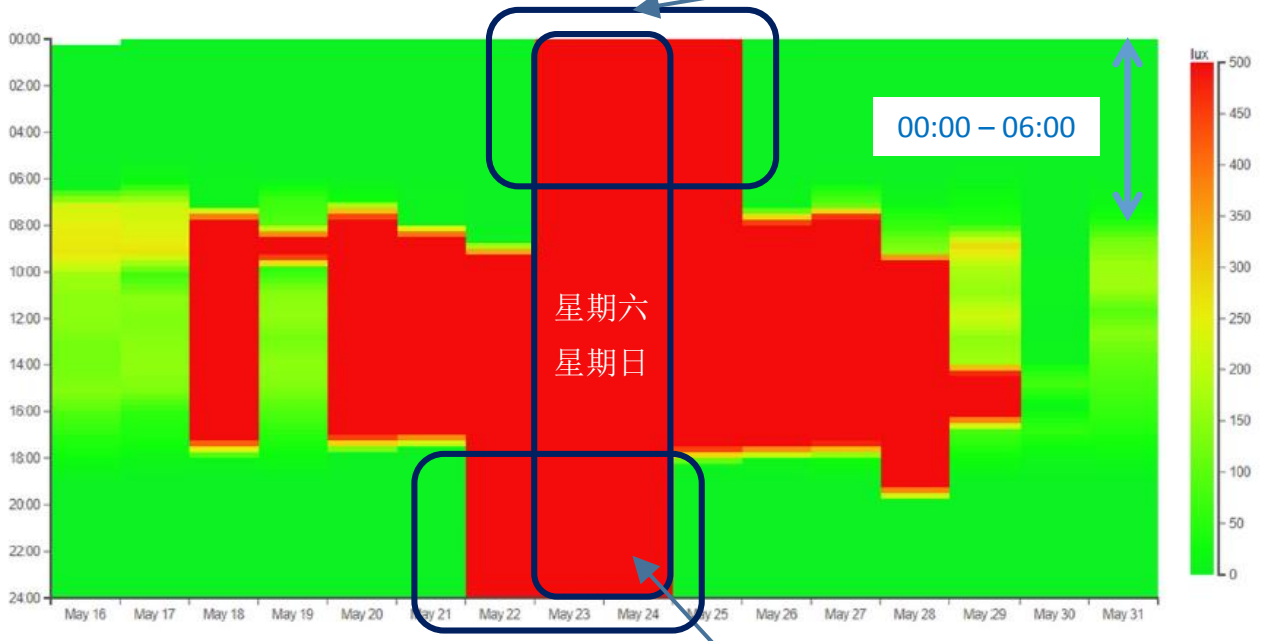


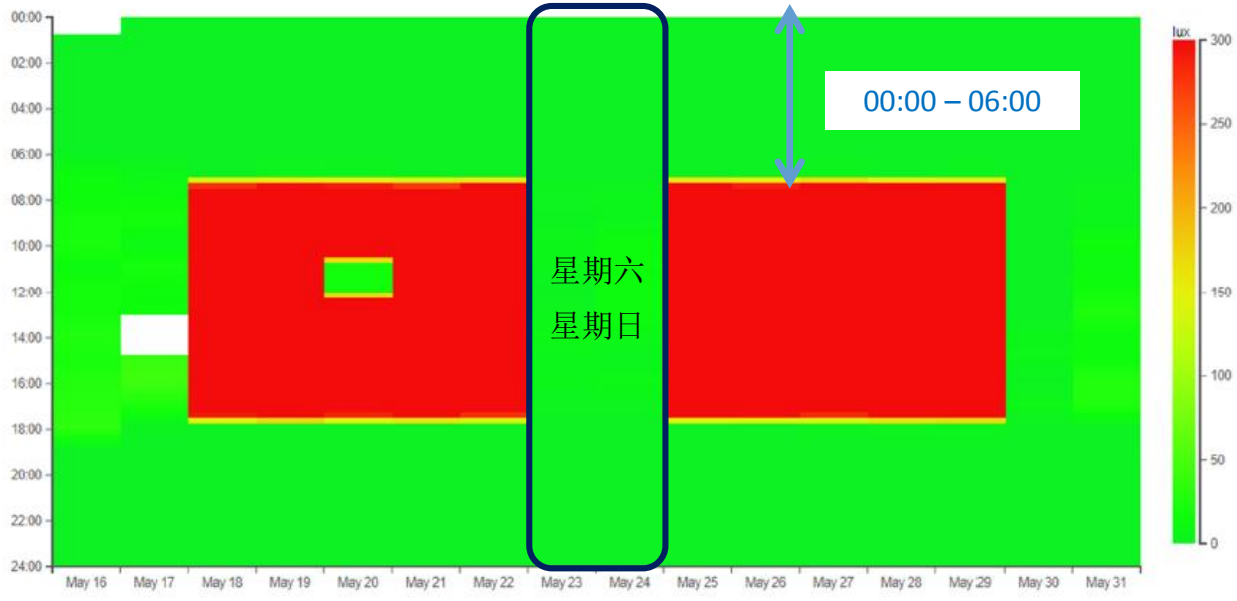
Figure. 1b Relative Humidity in July

再调适的常规观察

示例 2: 物联网传感器的照度水平数据记录

夜间异常运行

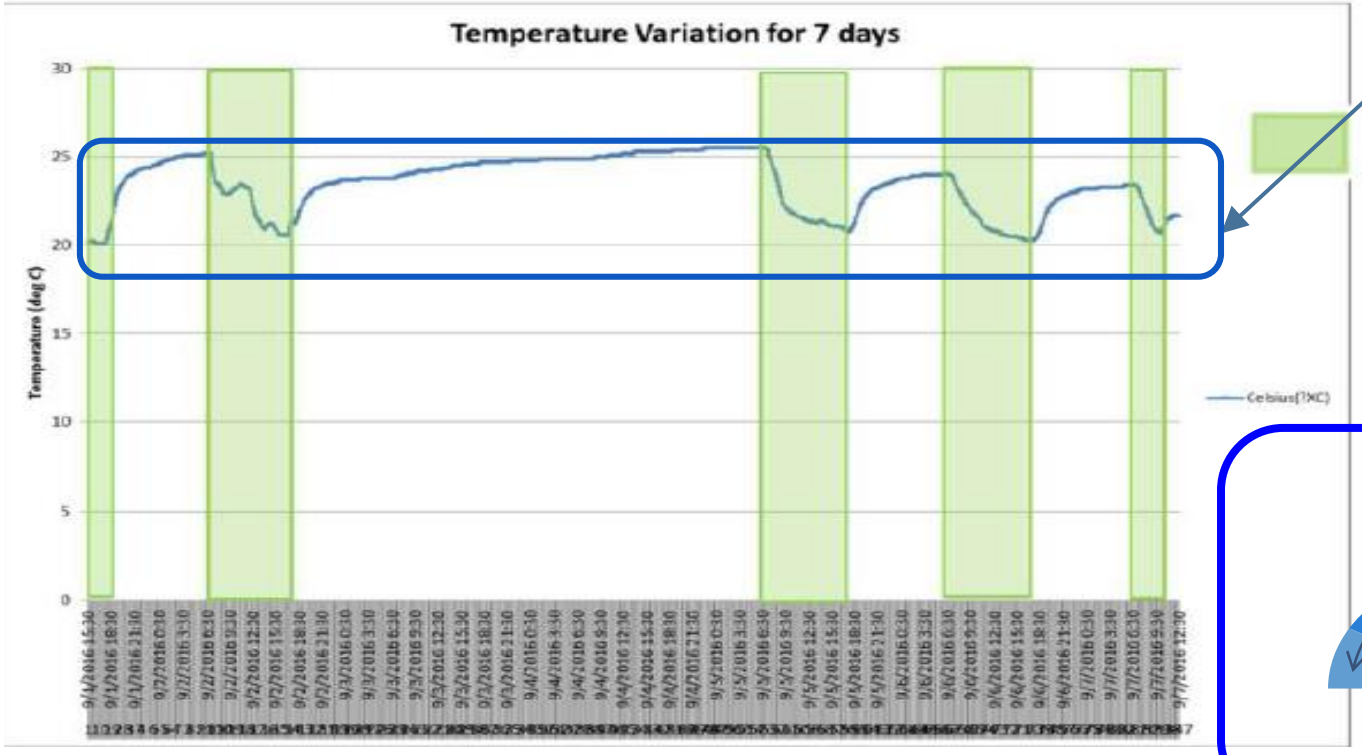




周末异常运行

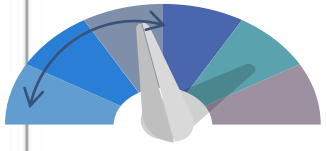
再调适的常规观察

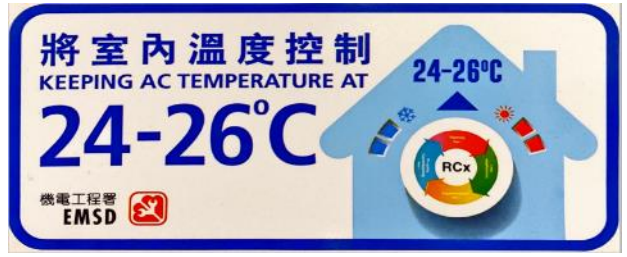
示例 3: 房间温度数据记录



办公时间室温偏低

设定点

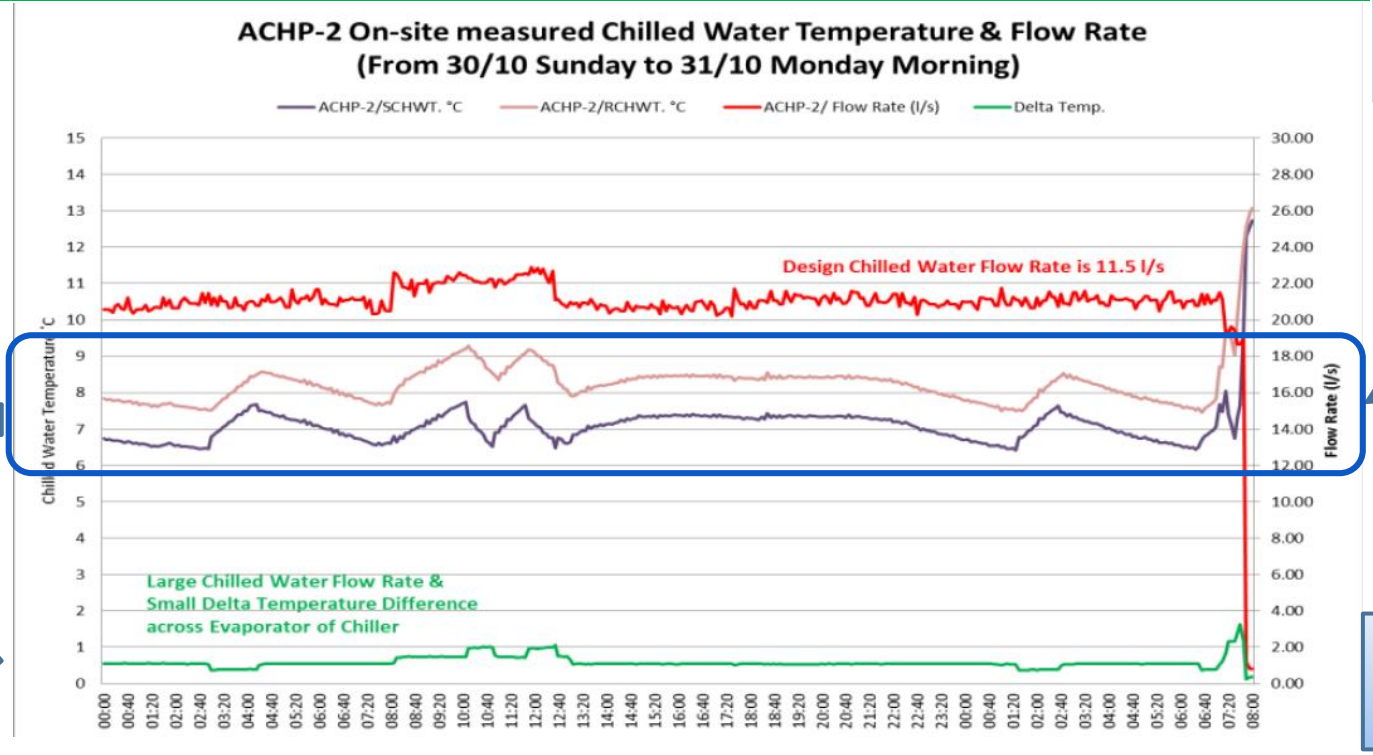




调整设定点以满足运行人员要求

再调适的常规观察

示例 4: 冷冻水流量与温度数据记录



冷冻水供水温度与回水温度之间的温差小
非办公时间的恒定冷冻水流量（部分负荷情况）

根据环境温度设定冷水机开/关时间表

Predicted Load. / Ambient (°C)	≤ 700 Tons	> 700 Tons To ≤ 1800 Tons
≥ 26.0 °C	2 4 3 1A 1B 5	4 2 3 1B 1A 5
≥ 15.0 °C To < 26.0 °C	1A 1B 3 4 2 5	2 4 3 1A 1B 5
< 15.0 °C (Winter Mode)	1B 1A 2 4 3 5	1B 1A 2 4 3 5

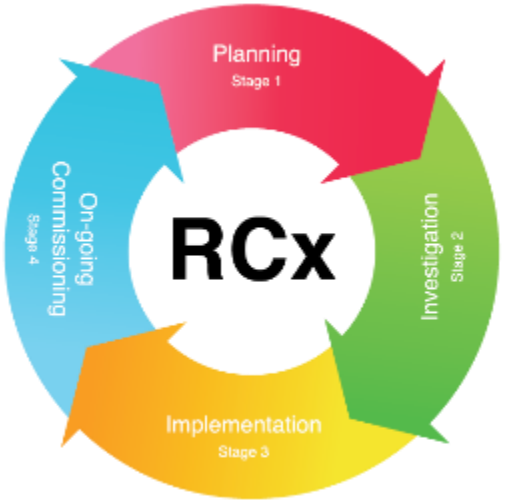
再调适的益处

低费用或零费用（短期回報）

改善建筑性能

改善建筑系统能效并提高设备使用寿命

减少维护花费



为运维人员提供合适的培训

改善系统可靠性

改善人员舒适度生产率

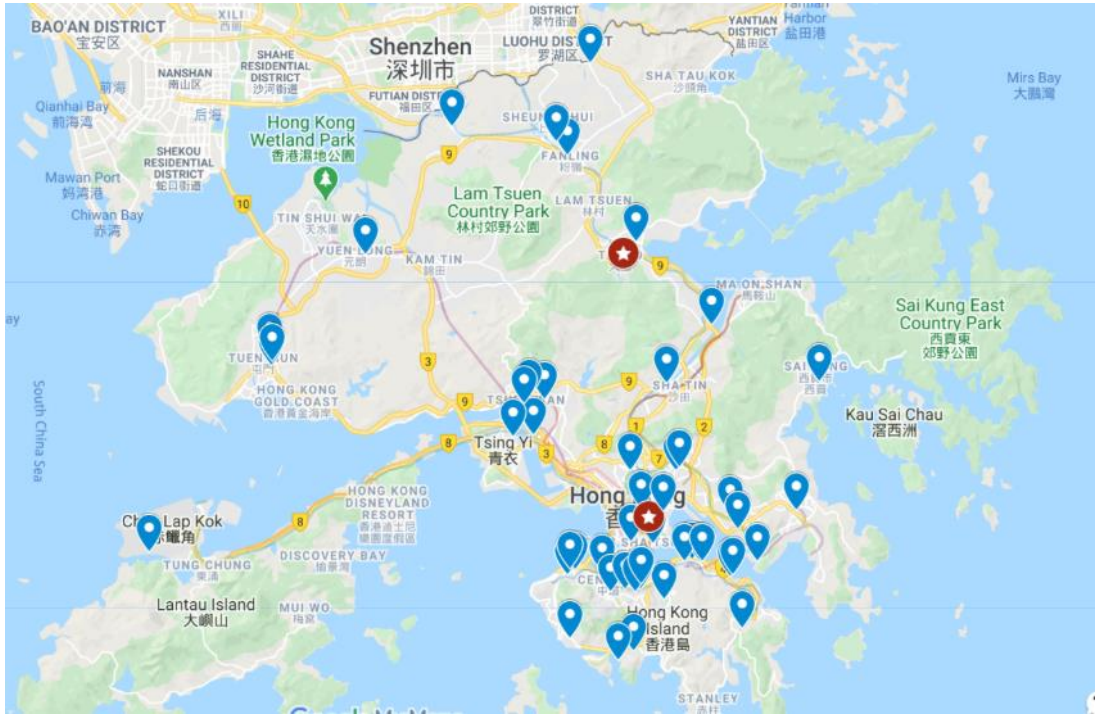
再调适实施阶段

政府工程项目

超过200个

历时7年 (从2019起)

1. 市政大楼
2. 政府合署
3. 游泳馆
4. 市政厅
5. 公众图书馆等



对再调适的支持

3

EMSD

再调适绿色校园2.0 – 简介会 & 讲座

绿 色 校 园 2.0
再 调 适

Register NOW!

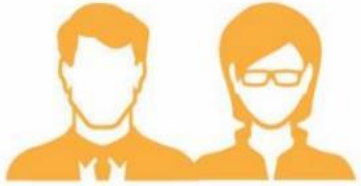
专业讲座

日期：2020年12月11日（周五）（1小时）

1. 介绍运行数据的应用
2. 介绍智能技术对再调适的促进

日期：2020年12月15日（周二）（1小时）

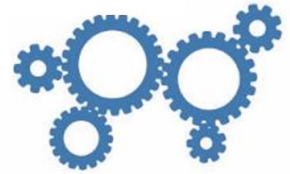
1. 香港绿色建筑议会再调适培训和注册方案
2. 公用事业资助计划



研讨会

日期： 2021年2月4日（星期四） （1小时）

1. 线上示范录像
   - 再调适现场评估
   - 实施节能措施，测量和验证过程
2. 再调适设备和成品分享
3. 问答环节

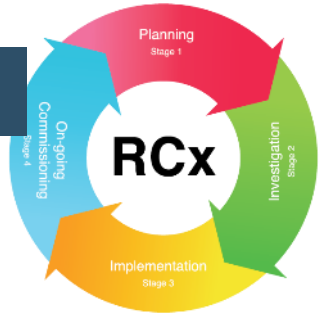


再调适资源中心

节能机会(ESO)

有用链接

成功个案



https://www.rcxrc.emsd.gov.hk

全民节能 – 获奖 & 成果

获奖 & 成果

AWARDS (ORGANISATION CATEGORY)	
Award	**Name of Organisation**
Hanson Grand RCx (Implementation) Award	Electric Tower
Outstanding RCx (Implementation) Award	One Island East
	One, Two Three Exchange Square and the Forum
	Pacific Place
Outstanding RCx (Proposal) Award	Gateway II
	Great Eagle Centre
	Towngas Headquarters Building
RCx Continuous Enhancement Merit	Lippo Centre
RCx Special Challenge Merit	Belilios Public School
RCx Technical Approach Merit	Three Garden Road
RCx Merit Award	Cathay City
	Mikiki
	Ocean Centre
	Ocean Terminal Extension
	Sun Hung Kai Centre

The Environment Bureau and the Electrical and Mechanical Services Department jointly organized the "Energy Saving Championship Scheme 2019" through application of innovation and technologies, the energy saving and conservation in buildings in the community are targeted to be further enhanced. There are two categories of the Championship Scheme this year: the organisation category and the student category. The organisation category is to encourage concerted efforts of organisations in different sectors to adopt "Retro-commissioning" (RCx) as a cost effective measure to enhance energy efficiency of existing buildings. The student category is to inspire the creativity of young people in energy saving and the application of renewable energy.

The response was overwhelming, with over 80 applications and over 200 applications respectively from organisations and students.

"Energy Saving Championship Scheme 2019" awards and results
https://www.energysaving.gov.hk/eschampion2019/en/awards/index.html

JUDGING PANEL

Organisation Category		Student Category	
Legislative Council	Ir Dr Hon WK LO (Chairman)	Hong Kong Green Building Council	Ir Colin CL CHUNG (Chairman)
The Hong Kong Institution of Engineers – Building Services Division	Ir Brian WL CHENG	The University of Hong Kong	Ir Prof Dennis YC LEUNG
Chartered Institution of Building Services Engineers (Hong Kong Branch)	Ir Dr Raymond KL CHAN	City University of Hong Kong	Ir Prof Michael KH LEUNG
American Society of Heating, Refrigerating and Air-Conditioning Engineers (Hong Kong Chapter)	Ir Jacky CL NG	Hong Kong Productivity Council	Ir Raymond CL FONG
Association of Energy Engineers (Hong Kong Chapter)	Ir Dr Conson KH YU	CLP Power Hong Kong Limited	Ir Eric PC CHEUNG
Building Services Operation and Maintenance Executives Society	Ir Chris TING	The Hongkong Electric Company Limited	Ir TC YEE
Hong Kong Association of Energy Engineers	Ir HO Sai Kling	The Hong Kong and China Gas Company Limited	Ir Duncan WO WONG
Energy Institute (Hong Kong Branch)	Ir YEE Kwong Fai	LEAPS	Ms Kata KWOK
LEAPS	Ir Ambrose CHEN		

Hanson Grand RCx (Implementation) Award
Electric Tower, HK Electric

Located at Ap Lei Chau, Electric Tower is one of the operation hubs of The Hongkong Electric Co., Ltd. (HK Electric), monitoring real-time the generation and distribution of electricity from Lamma Power Station to its customers. The team has been adopting Retro-commissioning (RCx) to identify and implement various Energy Saving Opportunities (ESOs) in the building, including the use of AI-based system for analysis and reduction of power consumption in data centre air-conditioning, continuously reviewing the operation and optimizing the existing MVAC systems, use of T5 LED lamps in some areas with smart controls, etc. With the team's excellent efforts in implementing the RCx strategies from Year 2013 to 2019, HK Electric's Electric Tower has achieved a significant reduction of electricity use of 30%.

Secondary and Post-secondary School Category: Hanson Grand Award
St. Stephen's Girls' College

Install the "Save N More" to your tap, it can instantly heat water directly to a preset temperature. With a temperature-controlled valve at the outlet, water is released only after reaching a designated temperature. This can help reduce energy loss in tanks and pipes. In addition, water will not be wasted during temperature adjustment. The infra-red sensor installed in the tap or shower head allows water to flow only when necessary. Water consumption data recorded by its built-in water meter will be transferred via IoT to one's mobile phone app which facilitates the user to properly plan one's water usage. In addition, this device considers the use of wastewater to generate electricity for energy recovery.

Primary School Category: Hanson Grand Award
PLK Dr. Jimmy Wong Chi-Ho (Tin Sum Valley) Primary School (Chan Hoi Chun)

AWARDS (ORGANISATION CATEGORY)

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RCx Merit Award	Cathay City
	Mikiki
	Ocean Centre
	Ocean Terminal Extension
	Sun Hung Kai Centre

AWARDS (STUDENT CATEGORY)

Award	Secondary and Post-secondary School Category	Primary School Category
Hanson Grand Award	St. Stephen's Girls' College (Chang Wing Lum, Hung Dorea Elaine, Leung Man Yi, Ma Ka Po, Wong Tsz Tung)	PLK Dr. Jimmy Wong Chi-Ho (Tin Sum Valley) Primary School (Chan Hoi Chun)
Hanson Outstanding Awards	City University of Hong Kong (Wan Ho Ching)	King's College Old Boys' Association Primary School No. 2 (Lee Cheuk Ip)
	Shun Tak Fraternal Association Yung Yau College (Cheung Wing Yin, Tong Wai Yan, Wong Tsz Yau)	PLK Horizon East Primary School (Chan Ting Hei)
	St. Teresa Secondary School (Chan Cheuk Yiu, Chow On Yuet, Li Pik Yi, Xue Culyi)	St. Paul's Primary Catholic School (Cheng Ching Lam)
	The University of Hong Kong (Kwok Yu Ho, Zhang Yingguang)	St. Paul's Primary Catholic School (Tsang Hiu Wing)
Hanson Merit Awards	City University of Hong Kong (Shek Hoi Ying)	HKUGA Primary School (Melissa Chee)
		HKUGA Primary School (Eckhoff Veronica)
	HKUGA College (Chua Man Shan, Chan Hei Lui Kiandra, Lee Tsz Hei, Leung Wing Kai)	PLK Camões Tan Siu Lin Primary School (Choi Cheuk Hin)
		PLK Horizon East Primary School (Yim Wai Pok)
	HKUSPACE Community College (Ma Yi Kit)	S.K.H. Tsoung Kwan O Kei Tak Primary School (Ip Yan Yu)
		St. Matthew's Lutheran School (Sau Mau Ping) (Cho Nga Ching)
		St. Matthew's Lutheran School (Sau Mau Ping) (Leung Ka Ching)
	Ng Yuk Secondary School (Ma Shi Lun, Chung Tin Oi, Lau Kai Kin, Tse Sum Yi)	St. Paul's Primary Catholic School (Pang Cheuk Laam)
		Tai Koo Primary School (Chuk Wai Kiu, Atta)
		Tai Koo Primary School (Lam Wing Ki, Rachel)
Outstanding Participation School Awards	City University of Hong Kong	PLK Horizon East Primary School
	St. Teresa Secondary School	St. Matthew's Lutheran School (Sau Mau Ping)
Best Presentation Award	City University of Hong Kong (Shek Hoi Ying)	
Best Potential Award	St. Teresa Secondary School (Chan Cheuk Yiu, Chow On Yuet, Li Pik Yi, XUE Culyi)	

www.energysaving.gov.hk/eschampion2019/en/awards/index.html

我们已经做到什么?

- 风柜 (AHU)
  送回风
  温度重设
- 风柜
  静压重设
- 使用光电管和
  占用传感器
- 根据停车场通风需求使用
  CO传感器

- 通过低运行频率来优化
  冷冻水泵的运行数量
- 对解耦器系统冷水机组二级泵
  优化
  (一级和二级冷冻水流量平衡)

我们已经做到什么?

将老化的风冷冷冻水机升级为水冷

基于AI系统 的数据收集、分析和系统控制

冷水机组的屋宇管理系统数据收集、分析和系统控制

对空气侧和水侧设备（风柜/泵/风扇等）使用变速驱动(VSD)控制

EC插头风扇用于风柜

可变电压变频(VVVF)系统进行改造

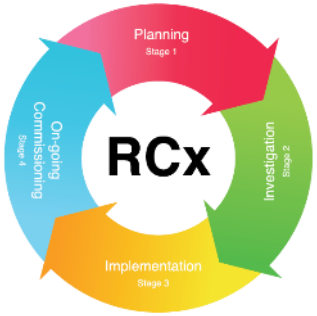
... 和更多!

www.energysaving.gov.hk/eschampion2019/en/awards/index.html

再调适培训与注册计划

- 于2019年11月26日推出
- 由香港绿色建筑议会主办
- 机电署及其他团体的支持
- 从业人员三层级：-
  - 再调适从业员等级1
  - 再调适从业员等级2
  - 再调适专家

15 Dec 2020 (Tue)



EMSD

公用事业基金计划

绿适楼宇基金

CLP 中電

Energy for Brighter Tomorrows

合格

建筑

- 居住建筑
- 商业建筑
- 工业建筑

能源效率提升项目

- 屋宇设备改造安装
- 再调适
- 基于建筑的智能技术

2020年12月15日
（星期二）

EMSD

公用事业基金计划

智「惜」用电楼宇基金 **(SPBF)**

港燈 HK Electric

智惜用電 smart power

合格

建筑

- 居住建筑
- 教育、福利与社区组织
- 工商业建筑

能源效率提升项目

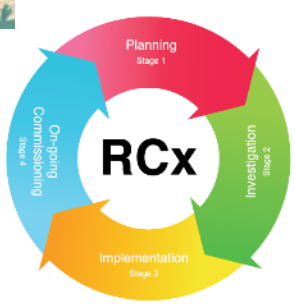
- 屋宇设备改造安装
- 再调适
- 基于建筑的智能技术

智惜用電 smart power
樓宇基金
BUILDING FUND

2020年12月15日
（星期二）

EMSD

让我们一起为了节能做出贡献



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機電工程署 EMSD