Typical Problems of AHU and Air Movement in Buildings

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- **Supply More Than Needed**
  - TP1: Oversize of fresh air supply
  - TP2: CAV serving big space
  - TP3: Continuously running in partial time occupied zones
- **Wrong Air Handling Process and Control**
  - TP4: Dislike fresh air?
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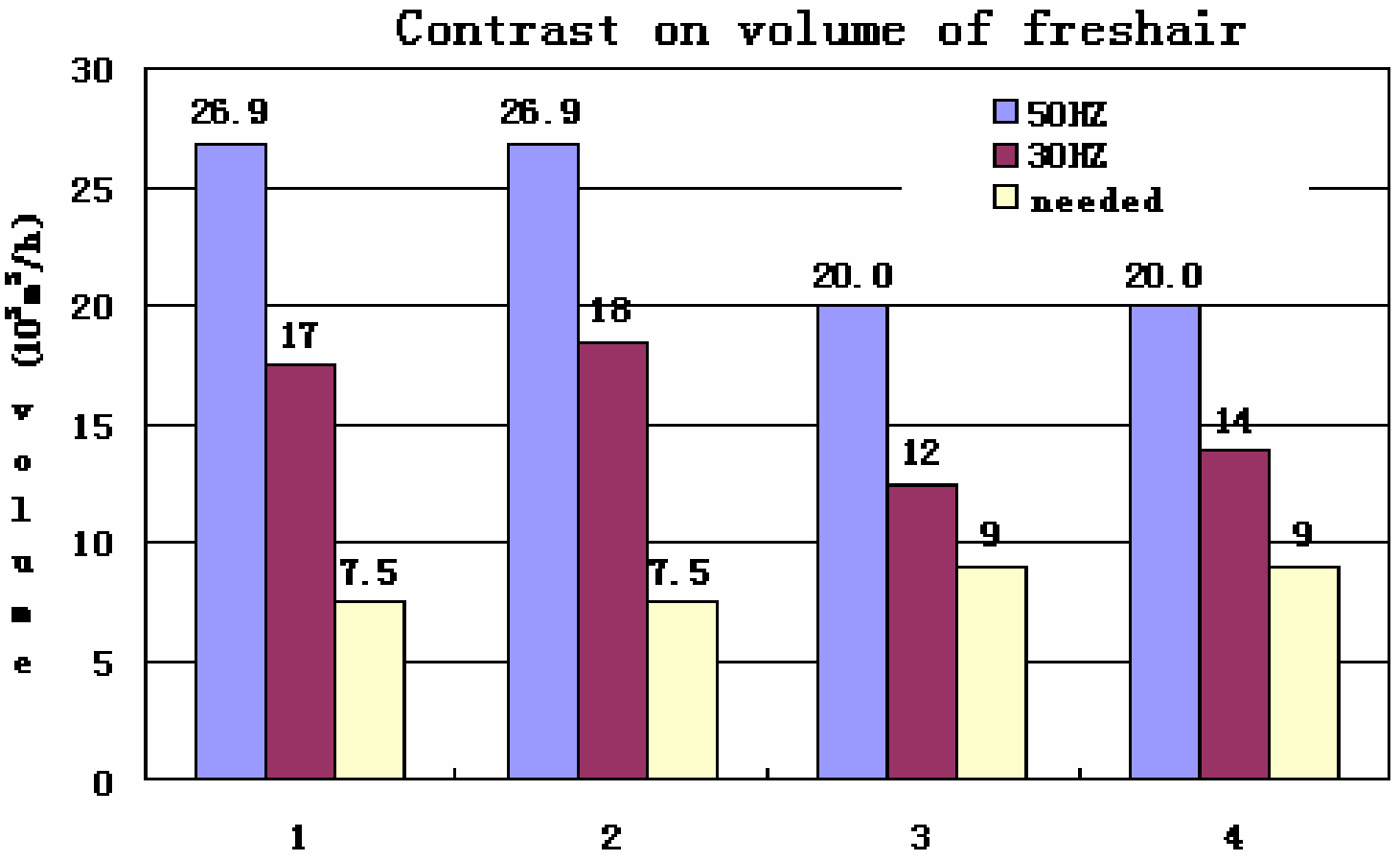
- **Unexpected Air Movement in Buildings**
  - TP6: Chimney effect leading to fresh air intake in high-rise buildings
  - TP7: Local air exhaust increasing cooling load

Solution: VFD



Electricity saved

- **50Hz→30Hz**
- **100m³/h.p→50m³/h.p**
- **electricity of fans saved:**

  working hours per day：15.5h， saved：1727kWh/d

  operating days per year：250d， saved：430,000kWh/a

- **electricity saved through reducing the cooling load.**

  load：14.1kJ/kg; volume saved:37790m³/h; average COP：4.82

  Operating days：120

  saved：68,500kWh/yr.

TP2

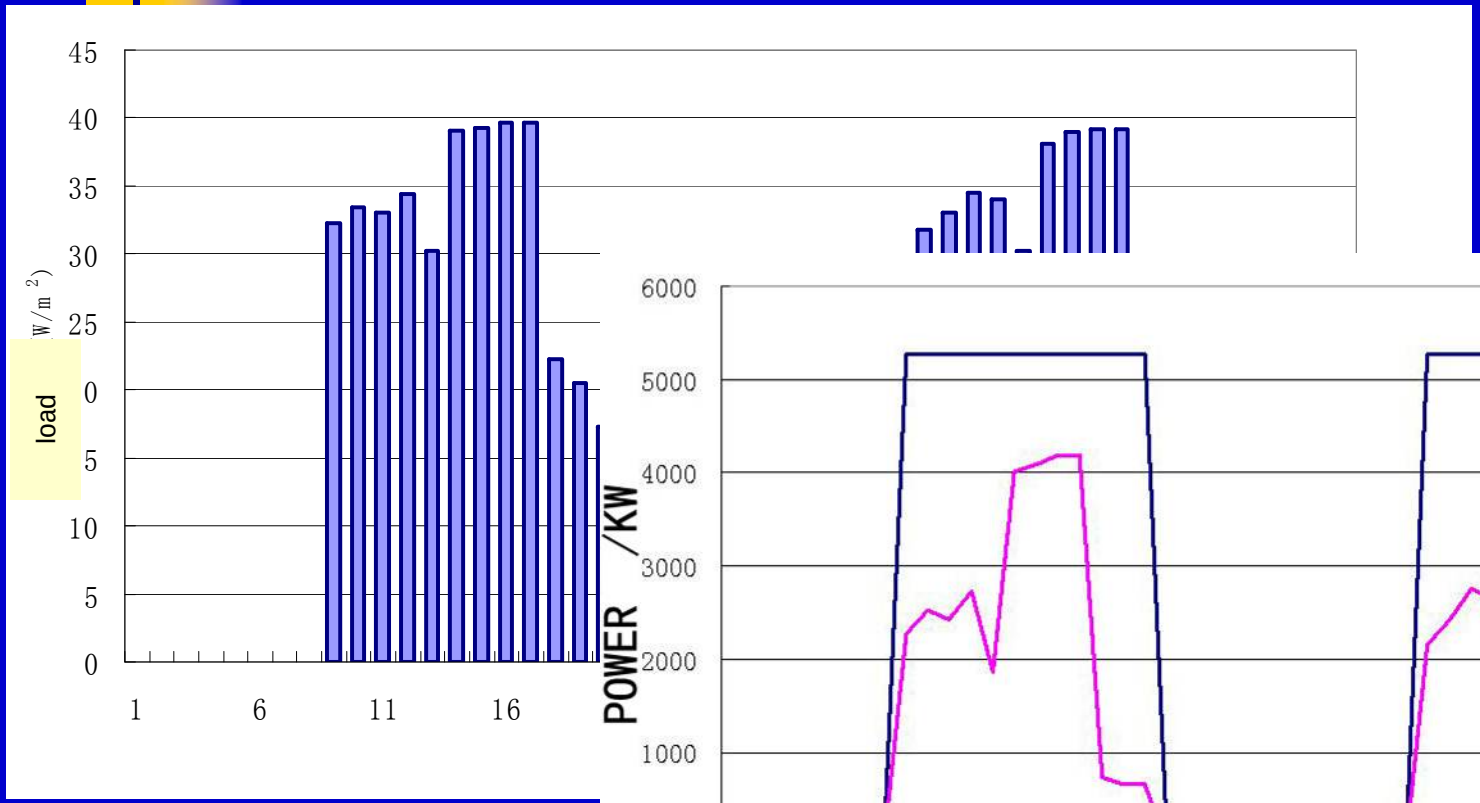
- **Example: a shopping mall B**
  - Gross area:510,000m^2,
  - Cooling area:380,000m^2
  - Air-conditioning style: all-air systems
  - Number of AHU: 530

Power (kW)	30	15	12	11	8.8	7.5	7.2	5.5	3.6	3	2.4	2.2	1.8	1.6	0.8
number	33	8	12	229	12	128	4	52	12	5	3	15	6	4	7

TP2

- **Status**
  - Electricity used by fans is very large ,near 2/3 of the total consumption of air-conditioning.
  - The volume of air supply can’t go with the change of load.
  - When several people in mall, fans have to run with full load.
- **Proposed solution**
  - Add VFD to change the volume of air supply to meet the change of load.

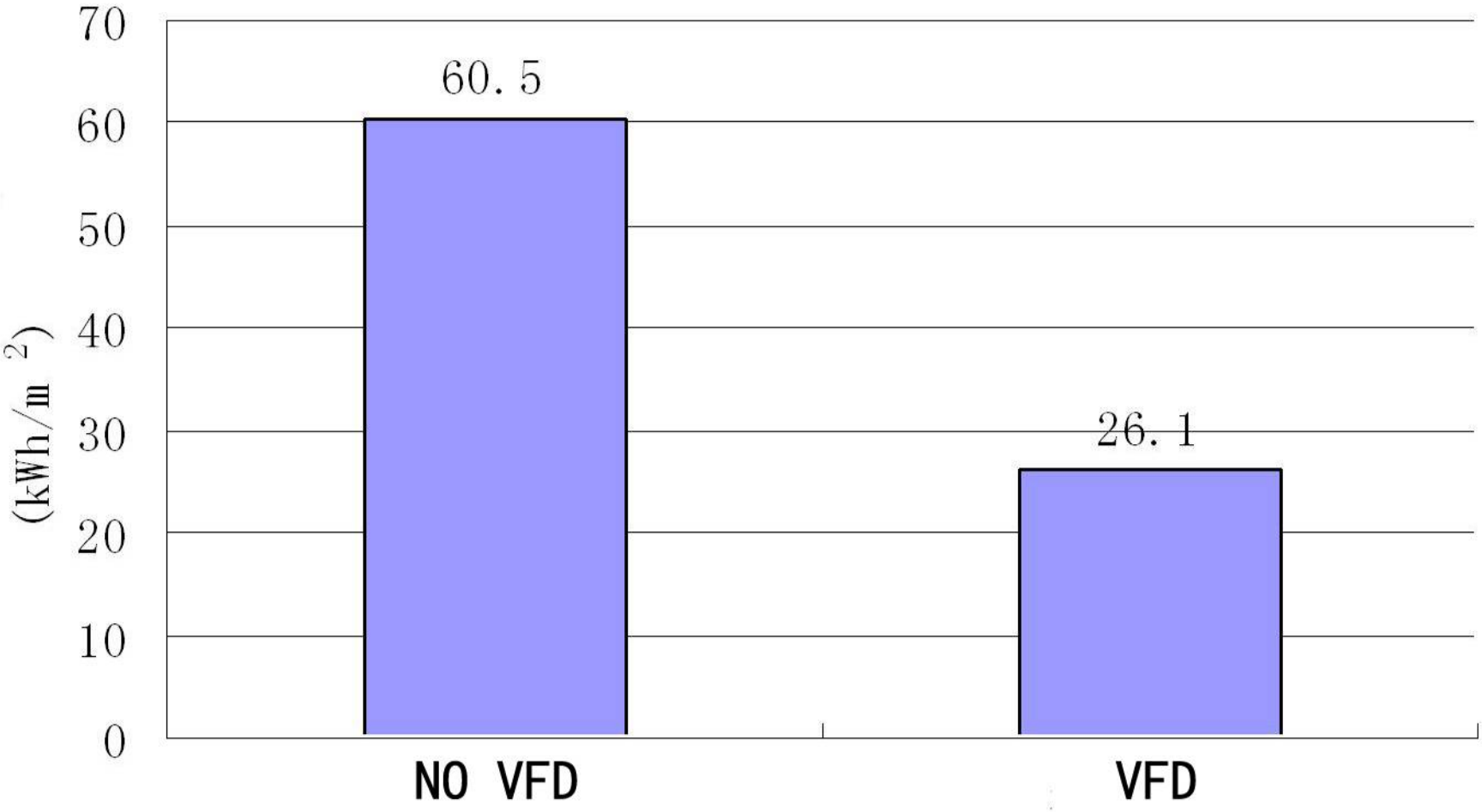
Proposed solution——VFD



Load curve ir

Power of Fan

Power saved



TP3

Example: government bldg. C

Status

- Some special areas in the building, such as meeting room, dinning-room, gymnasium hall, etc..
- Their AHUs need to run 24h continuously even when there is no people at all.

Solution

- **AHU for dinning-room operations according to the dinner time.**
  - On: half or one hour before dinner
  - Off: at the end of dinner.

Solution

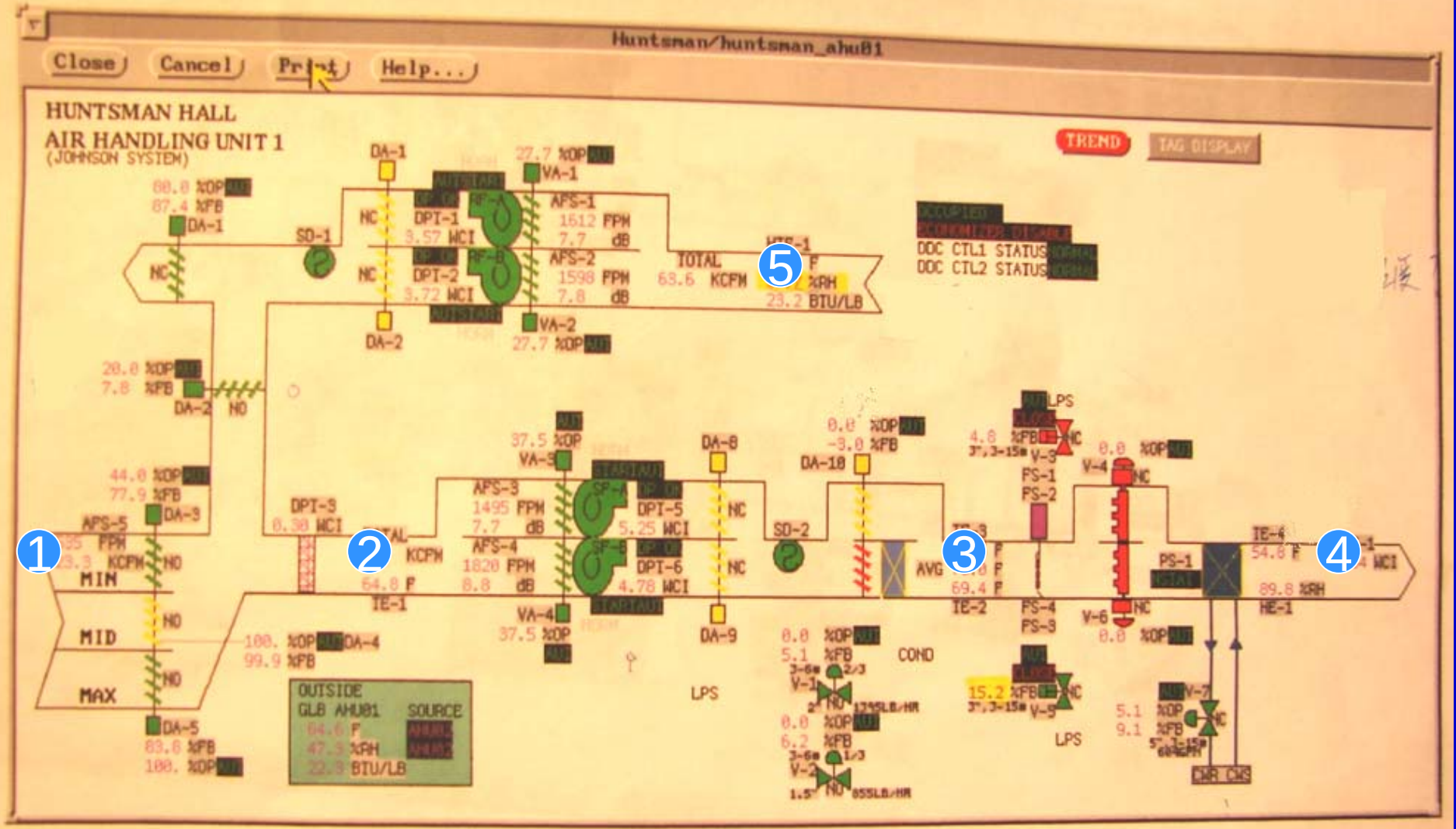
- **Meeting-room**
  - Half an hour before meetings , turn off the damper of the fresh air and turn on the fan, using return air to lower temp. quickly.
  - When meeting is on ,open the damper to 20% to send fresh air
  - And change the frequency of fan to 30Hz to avoid noise and save energy

Electricity saved

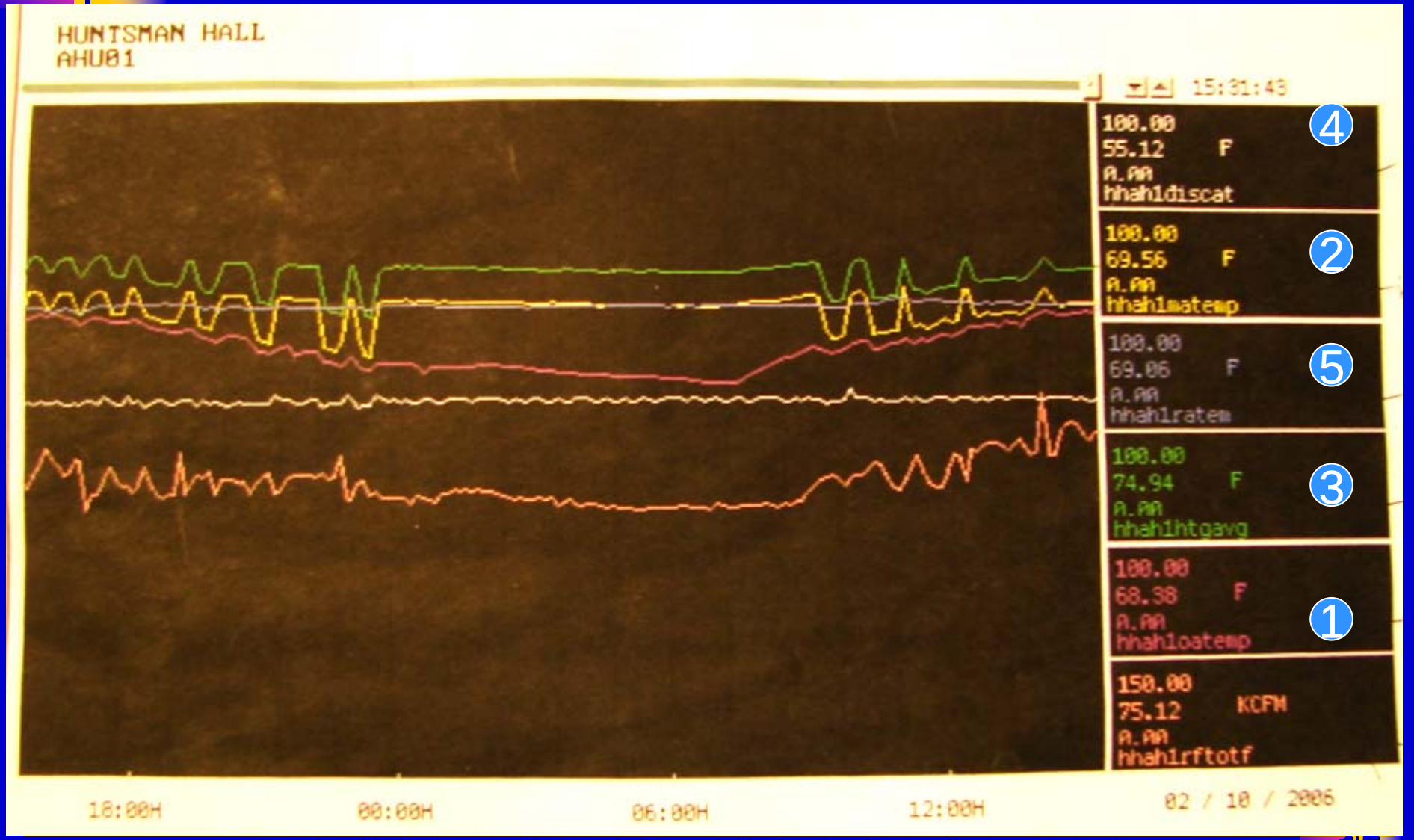
- Aim at different functional rooms, set different strategies and write these to BAS

- In building C , by the methods mentioned above, we can save 67,000kWh/yr with a low cost.

TP4


Huntsman/huntsman_ahu01
Close
Cancel
Print
Help...
HUNTSMAN HALL
AIR HANDLING UNIT 1
(JOHNSON SYSTEM)
TREND
TAG DISPLAY
DDC CTL1 STATUS
DDC CTL2 STATUS
DA-1
VA-1
APS-1
1612 FPM
7.7 dB
DPI-1
3.57 WCI
APS-2
1598 FPM
7.8 dB
DPI-2
3.72 WCI
VA-2
DA-2
SD-1
TOTAL
63.6 KCFM
23.2 BTU/LB
DA-9
APS-5
DPI-3
0.30 WCI
MIN
MID
MAX
DA-5
63.6 %FB
DA-4
99.9 %FB
IE-1
64.8 F
APS-3
1495 FPM
7.7 dB
APS-4
1820 FPM
8.8 dB
DPI-5
5.25 WCI
DPI-6
4.78 WCI
VA-3
VA-4
37.5 %OP
DA-8
DA-10
SD-2
AVG
IE-2
69.4 F
LPS
PS-1
PS-2
PS-3
PS-4
V-3
V-4
V-5
V-6
V-7
IE-6
54.6 F
HE-1
89.8 %RH
COND
V-1
V-2
OUTSIDE
GLB AHU01
SOURCE
64.6 F
47.3 %RH
22.9 BTU/LB
CHR CWS
1
2
3
4
5

Temp. and Volume



TP4

- **Why not use fresh air in off-season?**
  - Fresh air has a Low T at night
  - We can close the cooling coil

TP5

TIME	OA TEMP/℃	OA RELATIVE HUMIDITY	SUPPLY AIR TEMP℃	RETURN AIR TEMP℃	COOLING LOADw/m^2	VALVE%
13:30	24.4	0.25	13.9	25.0	71.4	0.39
14:30	24.4	0.26	13.9	25.0	74.2	0.74
15:30	25.0	0.27	15.0	25.0	67.4	1
16:30	25.0	0.27	15.6	25.0	68.4	1
17:30	25.0	0.3	15.6	25.0	63.4	1
19:30	21.7	0.5	13.9	23.9	60.7	0.88
20:30	21.1	0.54	13.9	23.9	59.7	0.31
21:30	20.0	0.59	13.9	23.9	55.3	0.29
22:30	18.9	0.67	13.9	23.3	49.9	0.27
23:30	18.3	0.72	13.9	23.3	47.1	0.25
0:30	17.2	0.76	13.9	23.3	47.1	0.23
1:30	16.7	0.81	13.9	23.3	47.1	0.22
2:30	17.8	0.77	13.9	23.3	47.1	0.22
3:30	17.2	0.77	13.9	23.3	47.8	0.22

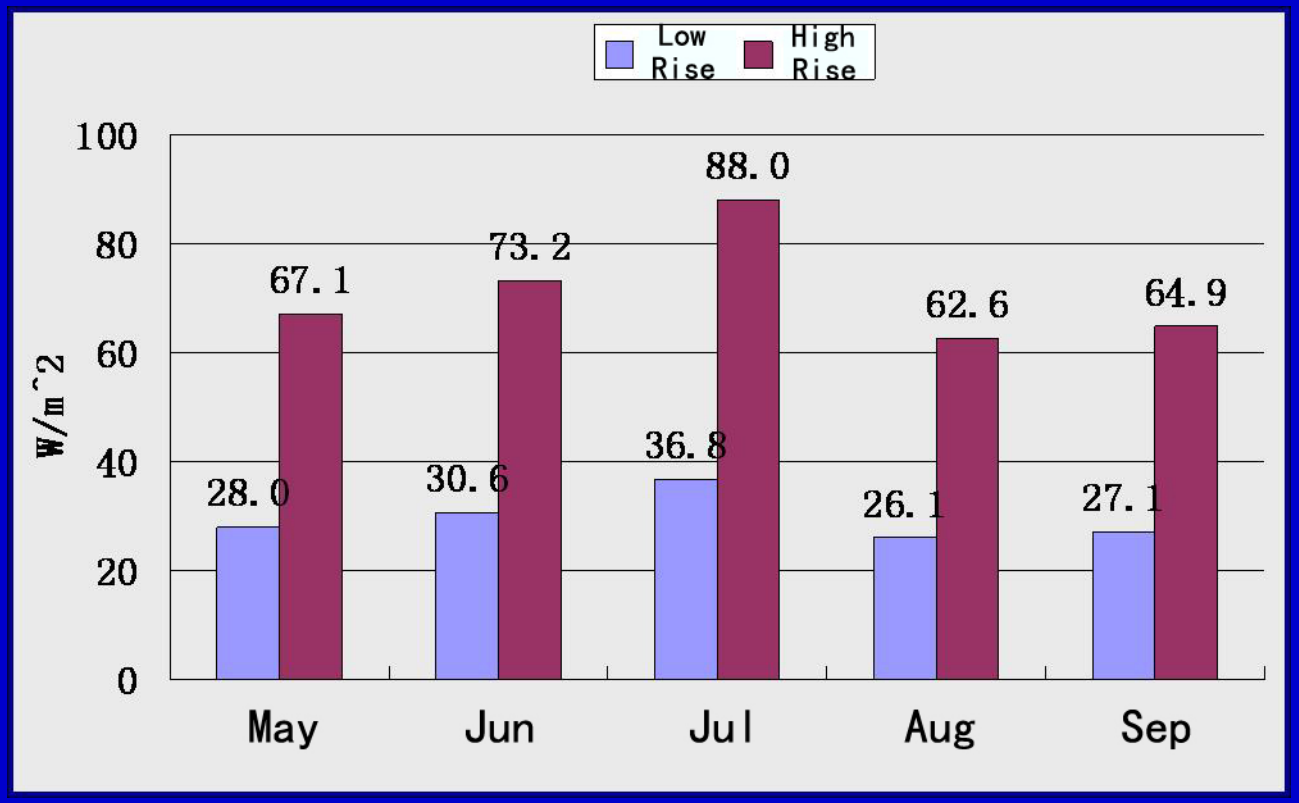
TP5

TAG	ROOM	OCCUPANCY	TEMP F	SETTING F	FLOW CFM	MINFLOW	DAMPER %	REHEAT VALVE
2-1	250	YES	73	73	796	800	33.6	20
2-2	247	YES	71.5	72	500	500	42.4	24.8
2-3	235	YES	71.8	72	656	650	56.8	27.2
2-4	228	YES	71.8	72	0	500	99.2	54.8
2-5	228	YES	72	72	0	600	100	66.4
2-6	203	YES	71.8	72	592	600	28	2.8
2-7	203	YES	72.2	72	424	450	38.4	4.8
2-8	203	YES	71.5	72	400	400	41.2	6.8
2-9	213	YES	72	72	220	200	50.4	14.8
10	213	YES	72.2	72	208	200	49.2	2
11	220	YES	72.8	72	0	650	100	0
12	220	YES	72	72	268	250	49.2	6.8
13	220	YES	71.8	72	352	350	43.6	2
14	220	YES	72	72	0	200	100	19.2

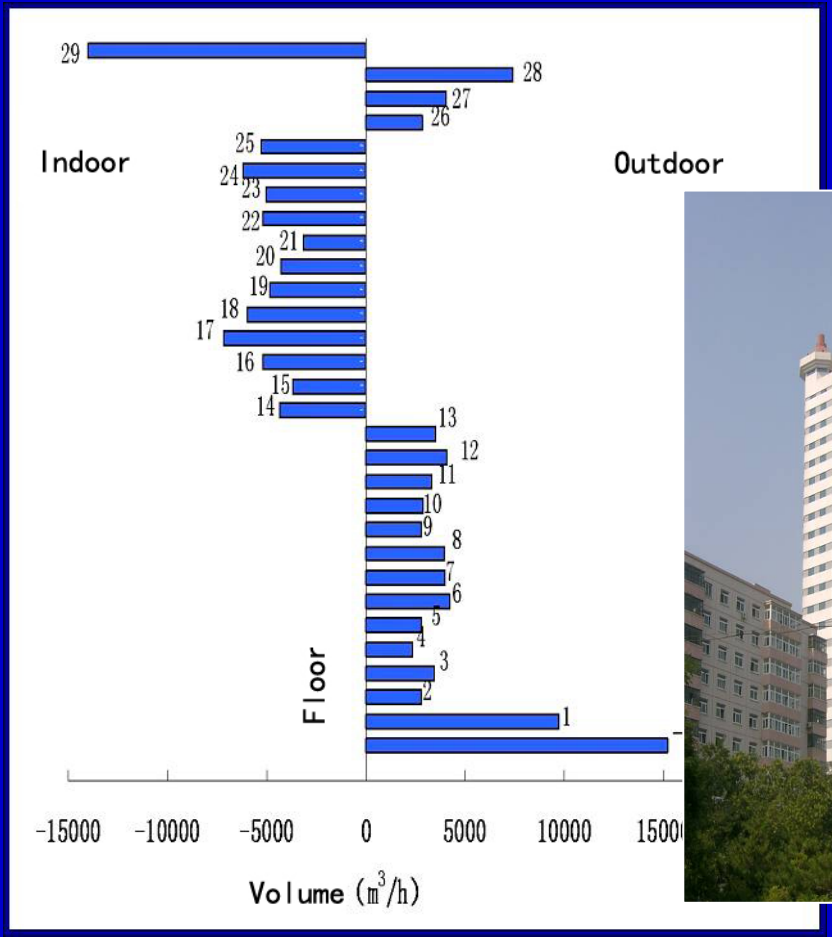
TP6

Example: E

Low rise: 1~17F; high: 18~28F

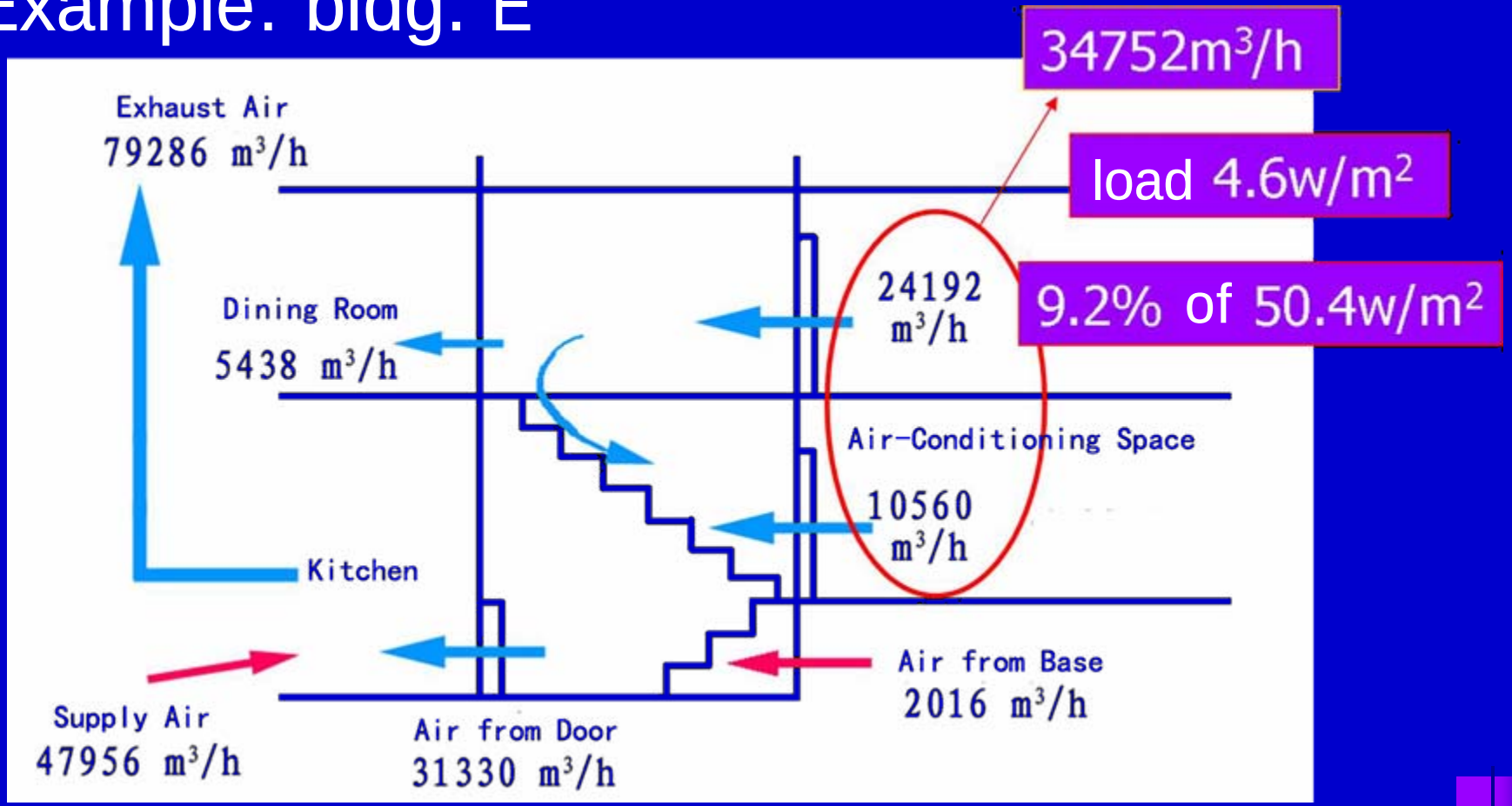


- Due to heat pressure, large amounts of heat and humidity air enters the building from high rise, and then out through the lower. The volume is about 74,400m³/h.
- Therefore, unexpected fresh air make the cooling load rise sharply. (load for fresh air amounts to 51.8%),



TP7

Example: bldg. E



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Solutions

- **To low the load of fresh air:**
  - Shut the windows during the operation time.
  - Reduce volume of air entering from un-conditioning areas, such as staircases, corridors, washing rooms, et.
- **To low the loss of energy supplied to the air-conditioning areas:**
  - Shut the doors of staircases to slow up the volume air caused by heat pressure.
  - Prevent the handled air into the un-conditioning area from the air-conditioning areas.

Thank you