Use of Innovative Solutions for Energy Savings at UBC or Are people *actually* there?

Blair Antcliffe
Energy Engineer

Energy Planning & Innovation
UBC Energy & Water Services

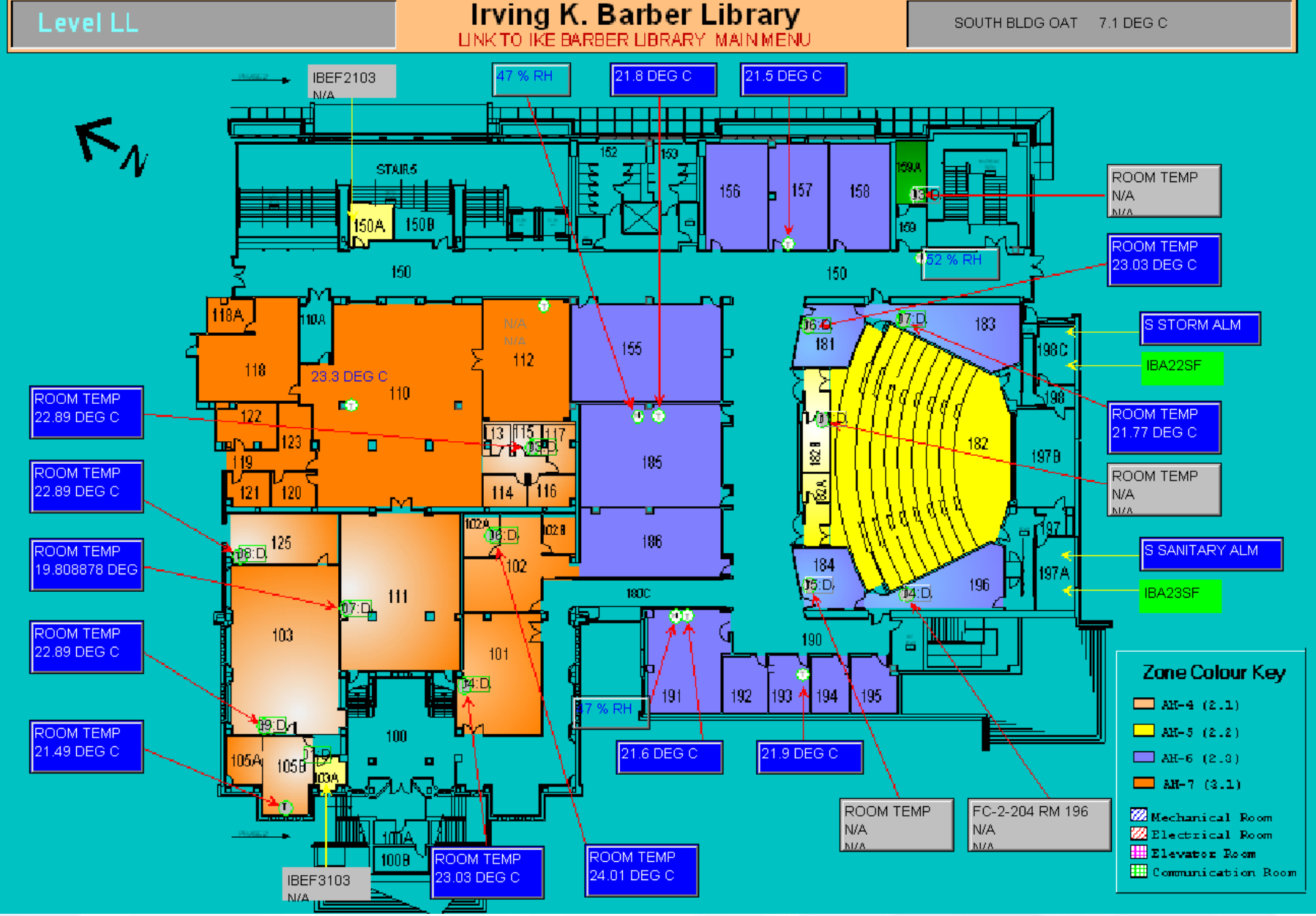
UBC Energy & Water Services

That’s my window!

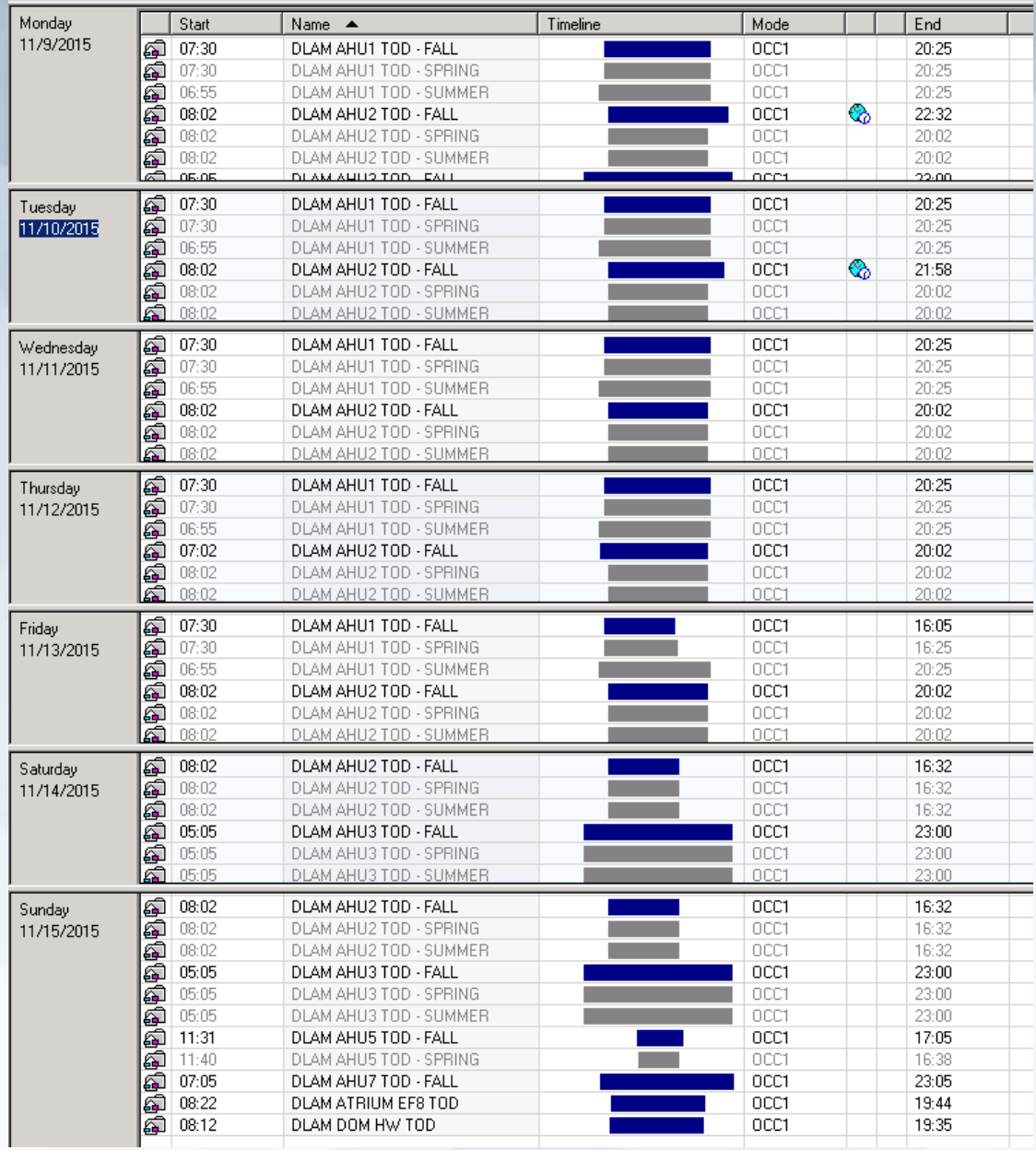
Why HVAC

Really though, what's its purpose?

- Keep spaces comfortable?
- Provide fresh air to spaces?


Level LL
Irving K. Barber Library
LINK TO IKE BARBER LIBRARY MAIN MENU
SOUTH BLDG OAT 7.1 DEG C
IBEF2103
N/A
47 % RH
21.8 DEG C
21.5 DEG C
ROOM TEMP
N/A
ROOM TEMP
23.03 DEG C
52 % RH
S STORM ALM
IBA22SF
ROOM TEMP
21.77 DEG C
ROOM TEMP
N/A
S SANITARY ALM
IBA23SF
ROOM TEMP
22.89 DEG C
ROOM TEMP
22.89 DEG C
ROOM TEMP
19.808878 DEG
ROOM TEMP
22.89 DEG C
ROOM TEMP
21.49 DEG C
23.3 DEG C
47 % RH
21.6 DEG C
21.9 DEG C
ROOM TEMP
N/A
FC-2-204 RM 196
N/A
ROOM TEMP
23.03 DEG C
ROOM TEMP
24.01 DEG C
IBEF3103
N/A
STAIRS
Zone Colour Key
AH-4 (2.1)
AH-5 (2.2)
AH-6 (2.3)
AH-7 (3.1)
Mechanical Room
Electrical Room
Elevator Room
Communication Room

State of the art scheduling



	Start	Name	Timeline	Mode	End
Monday 11/9/2015	07:30	DLAM AHU1 TOD - FALL		OCC1	20:25
	07:30	DLAM AHU1 TOD - SPRING		OCC1	20:25
	06:55	DLAM AHU1 TOD - SUMMER		OCC1	20:25
	08:02	DLAM AHU2 TOD - FALL		OCC1	22:32
	08:02	DLAM AHU2 TOD - SPRING		OCC1	20:02
	08:02	DLAM AHU2 TOD - SUMMER		OCC1	20:02
Tuesday 11/10/2015	07:30	DLAM AHU1 TOD - FALL		OCC1	20:25
	07:30	DLAM AHU1 TOD - SPRING		OCC1	20:25
	06:55	DLAM AHU1 TOD - SUMMER		OCC1	20:25
	08:02	DLAM AHU2 TOD - FALL		OCC1	21:58
	08:02	DLAM AHU2 TOD - SPRING		OCC1	20:02
	08:02	DLAM AHU2 TOD - SUMMER		OCC1	20:02
Wednesday 11/11/2015	07:30	DLAM AHU1 TOD - FALL		OCC1	20:25
	07:30	DLAM AHU1 TOD - SPRING		OCC1	20:25
	06:55	DLAM AHU1 TOD - SUMMER		OCC1	20:25
	08:02	DLAM AHU2 TOD - FALL		OCC1	20:02
	08:02	DLAM AHU2 TOD - SPRING		OCC1	20:02
	08:02	DLAM AHU2 TOD - SUMMER		OCC1	20:02
Thursday 11/12/2015	07:30	DLAM AHU1 TOD - FALL		OCC1	20:25
	07:30	DLAM AHU1 TOD - SPRING		OCC1	20:25
	06:55	DLAM AHU1 TOD - SUMMER		OCC1	20:25
	07:02	DLAM AHU2 TOD - FALL		OCC1	20:02
	08:02	DLAM AHU2 TOD - SPRING		OCC1	20:02
	08:02	DLAM AHU2 TOD - SUMMER		OCC1	20:02
Friday 11/13/2015	07:30	DLAM AHU1 TOD - FALL		OCC1	16:05
	07:30	DLAM AHU1 TOD - SPRING		OCC1	16:25
	06:55	DLAM AHU1 TOD - SUMMER		OCC1	20:25
	08:02	DLAM AHU2 TOD - FALL		OCC1	20:02
	08:02	DLAM AHU2 TOD - SPRING		OCC1	20:02
	08:02	DLAM AHU2 TOD - SUMMER		OCC1	20:02
Saturday 11/14/2015	08:02	DLAM AHU2 TOD - FALL		OCC1	16:32
	08:02	DLAM AHU2 TOD - SPRING		OCC1	16:32
	08:02	DLAM AHU2 TOD - SUMMER		OCC1	16:32
	05:05	DLAM AHU3 TOD - FALL		OCC1	23:00
	05:05	DLAM AHU3 TOD - SPRING		OCC1	23:00
	05:05	DLAM AHU3 TOD - SUMMER		OCC1	23:00
Sunday 11/15/2015	08:02	DLAM AHU2 TOD - FALL		OCC1	16:32
	08:02	DLAM AHU2 TOD - SPRING		OCC1	16:32
	08:02	DLAM AHU2 TOD - SUMMER		OCC1	16:32
	05:05	DLAM AHU3 TOD - FALL		OCC1	23:00
	05:05	DLAM AHU3 TOD - SPRING		OCC1	23:00
	05:05	DLAM AHU3 TOD - SUMMER		OCC1	23:00
	11:31	DLAM AHU5 TOD - FALL		OCC1	17:05
	11:40	DLAM AHU5 TOD - SPRING		OCC1	16:38
	07:05	DLAM AHU7 TOD - FALL		OCC1	23:05
	08:22	DLAM ATRIUM EF8 TOD		OCC1	19:44
	08:12	DLAM DOM HW TOD		OCC1	19:35

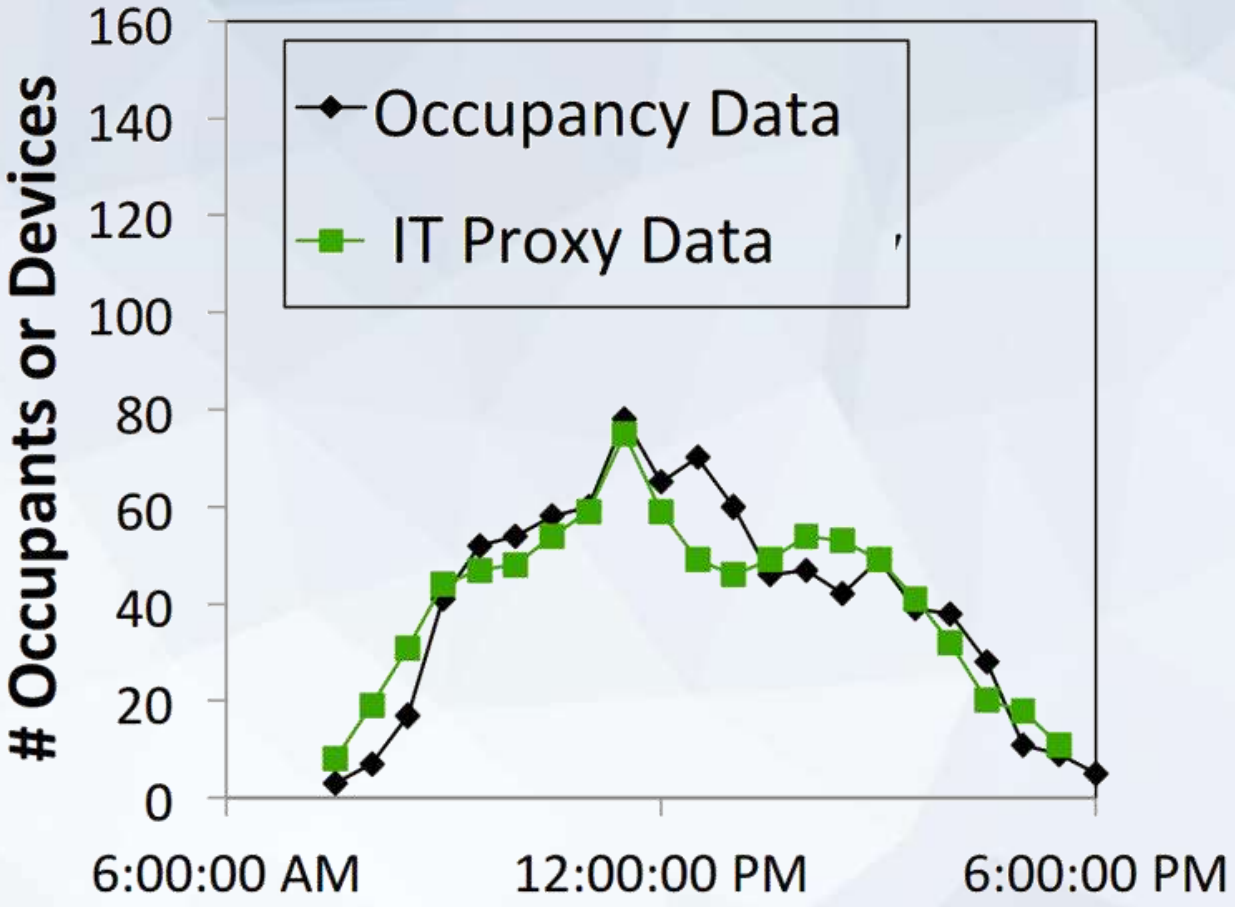
State of the art occupancy sensing

rce: Lutron Electronics Co.

Source: Nest Labs

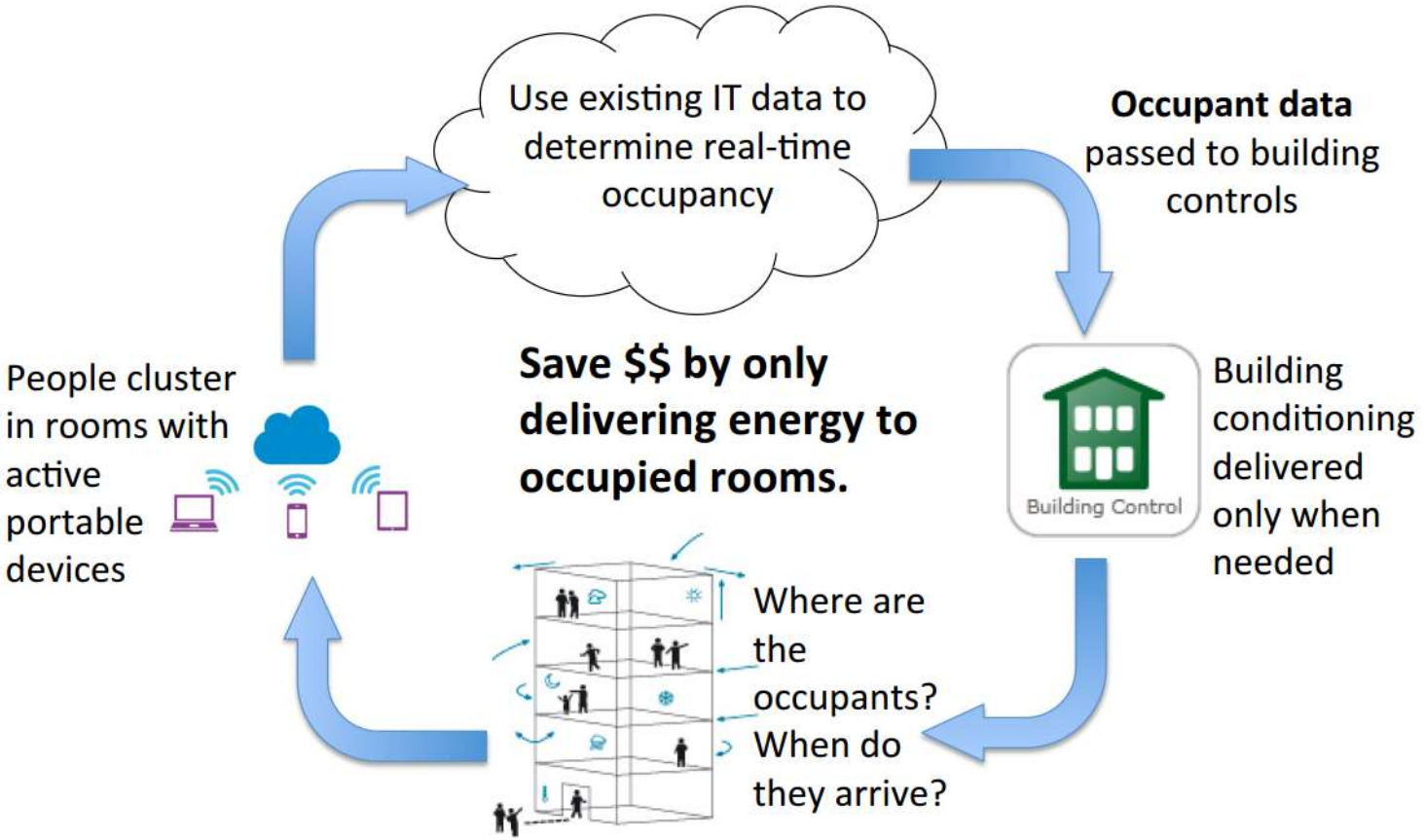
Rewind to 2013

Stefan Storey and his gaggle of undergrads




geekandsundry.com

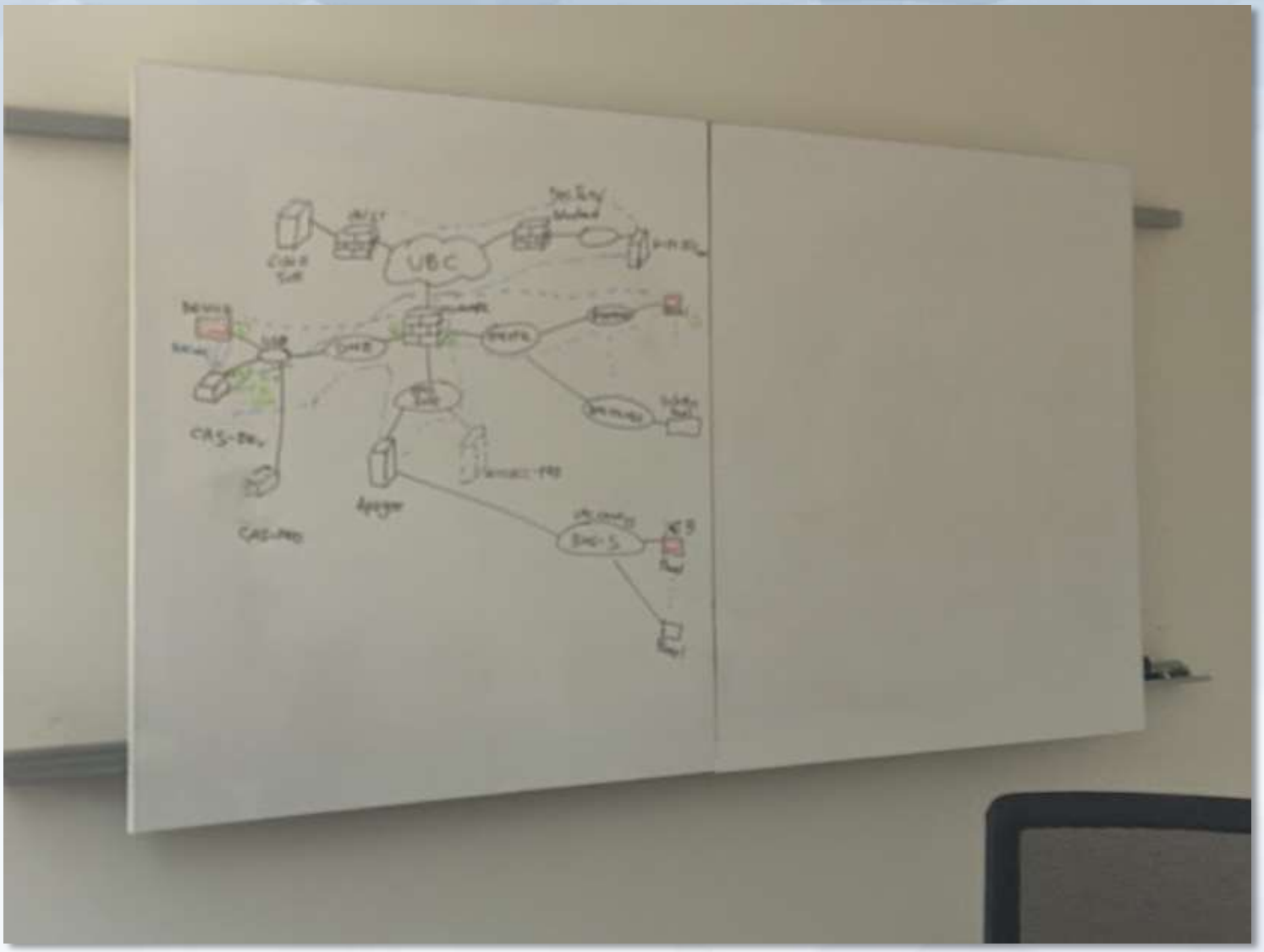
Occupant-driven Building Control

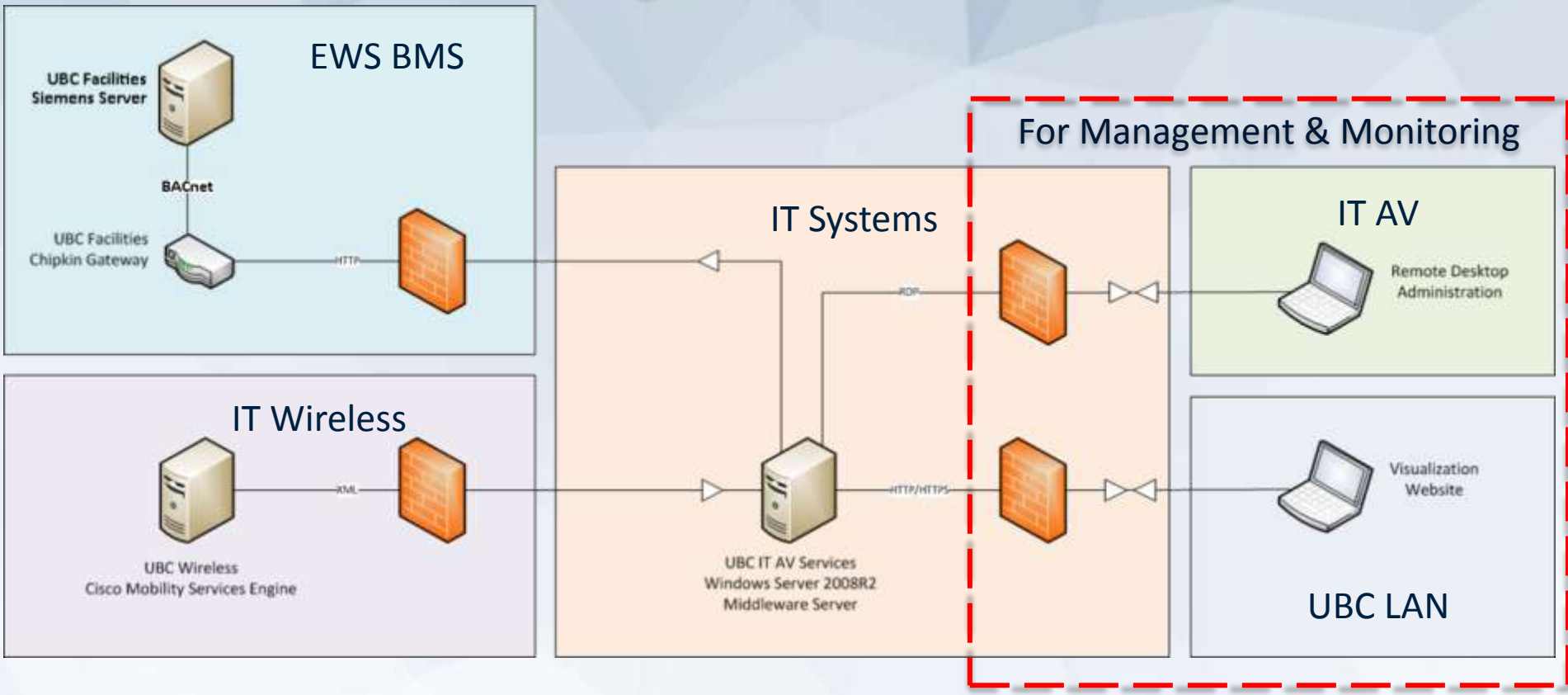


Individuals Involved

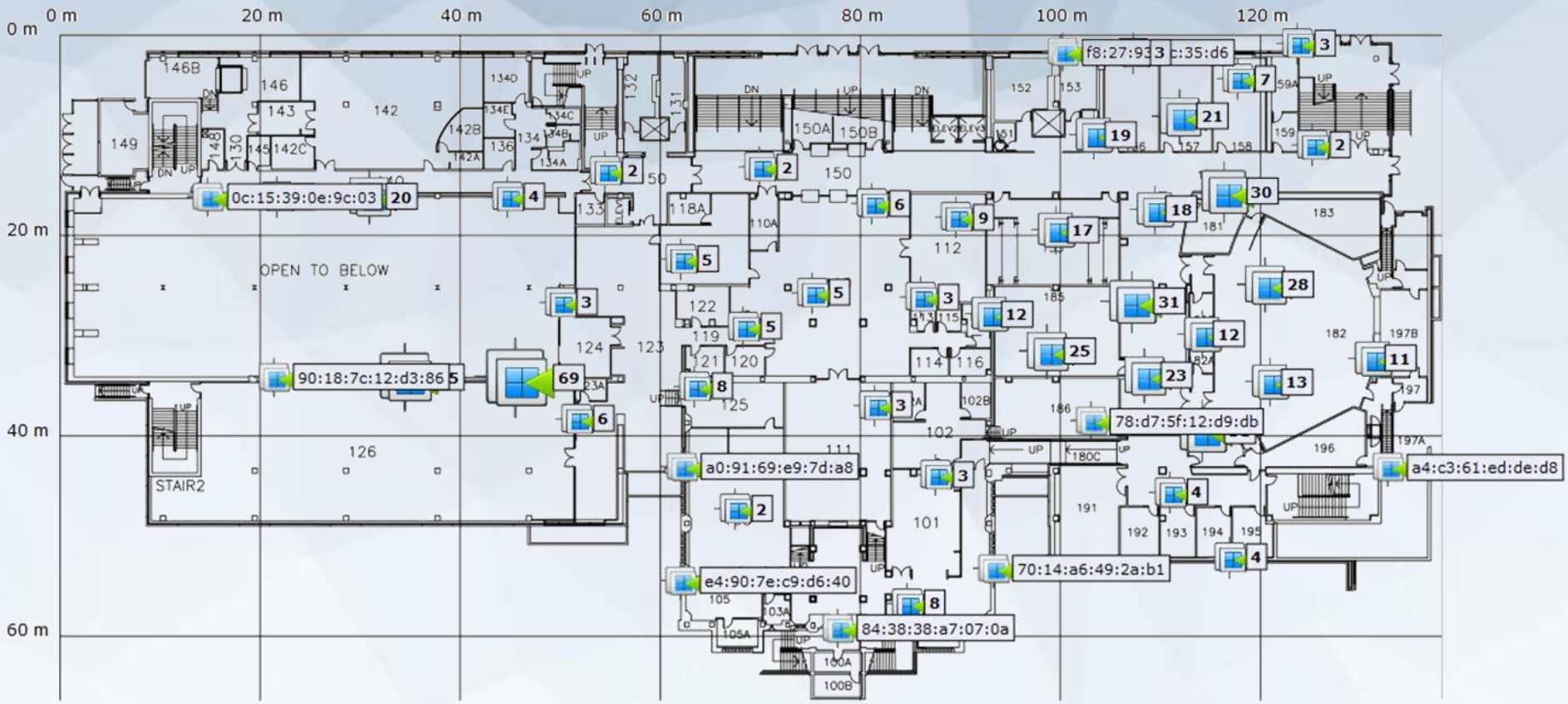
(Monumental effort)

- Blair Antcliffe (me)
- Stefan Storey
- James Montgomery
- Jesse Steiger
- Sean Woodruff
- Geoff Armstrong
- Jeremy Cohoe
- Bob Macdonald
- Justin Chia
- Scott Yonkman
- Michael Pal
- Calvin Lo


UBC
CAS-DB
CAS-PRD
Aggr



Modified from Jesse Steiger

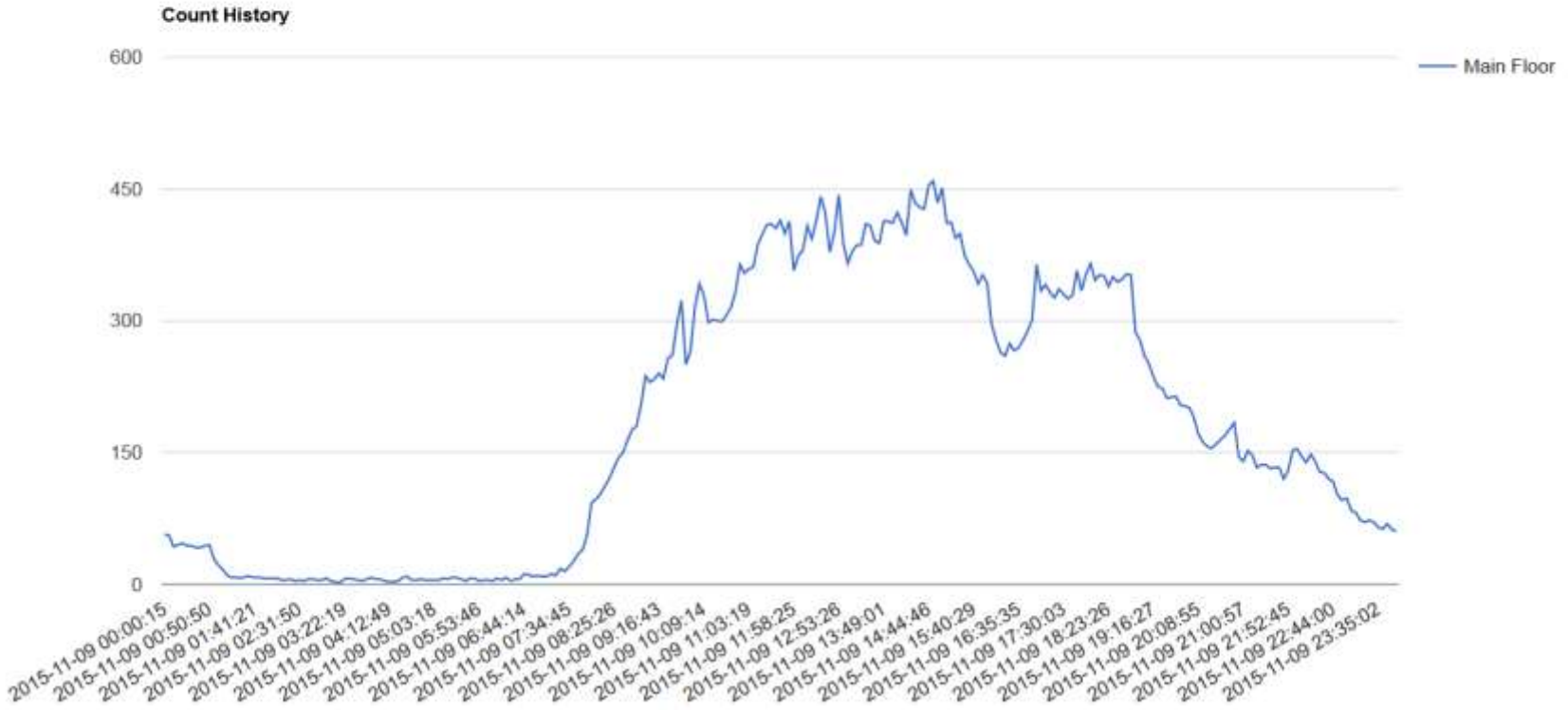

0 m
20 m
40 m
60 m
80 m
100 m
120 m
0c:15:39:0e:9c:03
90:18:7c:12:d3:86
a0:91:69:e9:7d:a8
e4:90:7e:c9:d6:40
84:38:38:a7:07:0a
70:14:a6:49:2a:b1
78:d7:5f:12:d9:db
a4:c3:61:ed:de:d8
OPEN TO BELOW
STAIR2

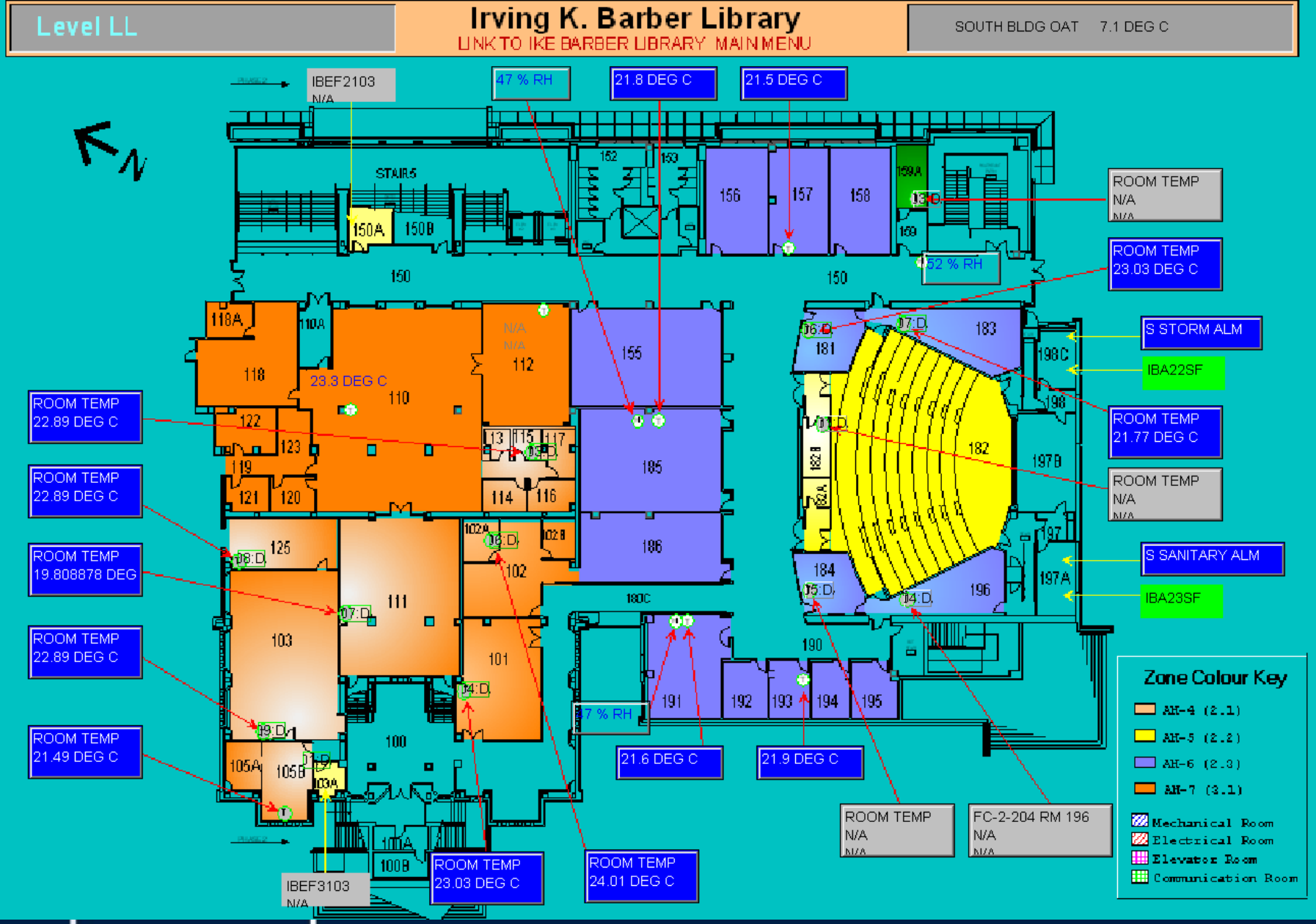

INFORMATION TECHNOLOGY
engage • envision • enable
AH-1
AH-2
AH-3
AH-4
AH-5
AH-6
AH-7
Building: Irving K. Barber - 516
Floor: Main Floor
Wireless Clients
Access Points
Client History
Chipkin History
3AM Snapshot
OPEN TO BELOW
STAIR2
473

Building: Irving K. Barber - 516 Floor: Main Floor

Wireless Clients | Access Points | Client History | Chipkin History | 3AM Snapshot

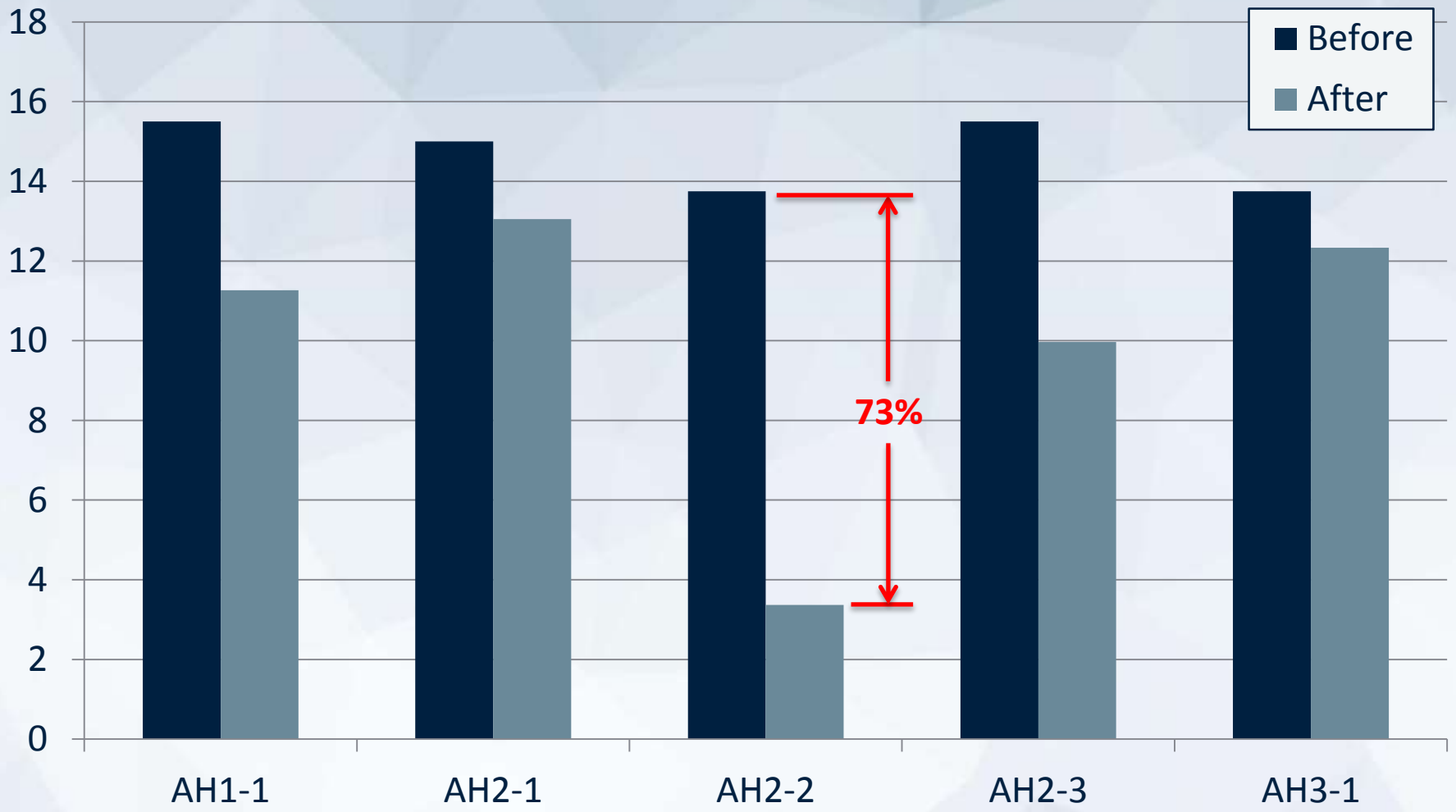
Select Date:
2015-11-9

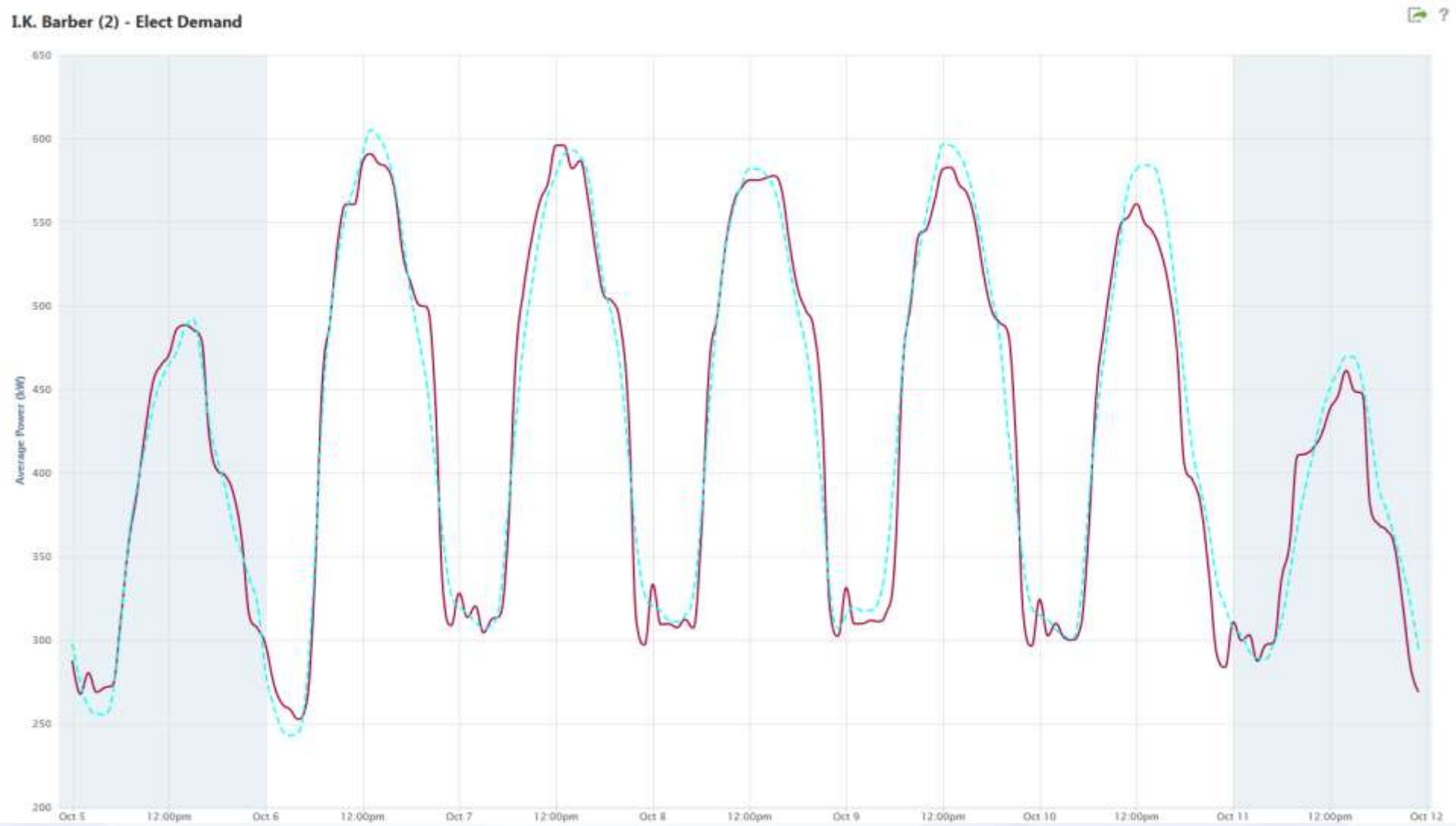



Level LL
Irving K. Barber Library
LINK TO IKE BARBER LIBRARY MAIN MENU
SOUTH BLDG OAT 7.1 DEG C
IBEF2103
N/A
47 % RH
21.8 DEG C
21.5 DEG C
ROOM TEMP
N/A
ROOM TEMP
23.03 DEG C
52 % RH
S STORM ALM
IBA22SF
ROOM TEMP
21.77 DEG C
ROOM TEMP
N/A
S SANITARY ALM
IBA23SF
ROOM TEMP
22.89 DEG C
ROOM TEMP
22.89 DEG C
ROOM TEMP
19.808878 DEG
ROOM TEMP
22.89 DEG C
ROOM TEMP
21.49 DEG C
23.3 DEG C
47 % RH
21.6 DEG C
21.9 DEG C
ROOM TEMP
N/A
FC-2-204 RM 196
N/A
ROOM TEMP
23.03 DEG C
ROOM TEMP
24.01 DEG C
IBEF3103
N/A
STAIRS
Zone Colour Key
AH-4 (2.1)
AH-5 (2.2)
AH-6 (2.3)
AH-7 (3.1)
Mechanical Room
Electrical Room
Elevator Room
Communication Room


IB_SEASON
SEASON
WINTER
BAC_400311_AI_1
FLR4-AHU1
180.00
187
LEVEL 3 North
LEVEL 3 South
BAC_400311_AI_1
FLR4-AHU4
145.00
149
185
BAC_400311_AI_1
FLR3-AHU1
249.00
256
LEVEL 2 North
LEVEL 2 South
BAC_400311_AI_1
FLR3-AHU4
247.00
250
BAC_400311_AI_9
FLR2-AHU2
1.00
1
BAC_400311_AI_8
FLR2-AHU1
56.00
57
LEVEL 1 North
LEVEL 1 South
BAC_400311_AI_1
FLR2-AHU4
182.00
181
263
BAC_400311_AI_3
FLR1-AHU3
0.00
0
BAC_400311_AI_2
FLR1-AHU2
111.00
125
BAC_400311_AI_1
FLR1-AHU1
2.00
9
LEVEL L North
LEVEL L South
BAC_400311_AI_4
FLR1-AHU4
0.00
0
BAC_400311_AI_7
FLR1-AHU7
39.00
33
BAC_400311_AI_5
FLR1-AHU5
42.00
61
BAC_400311_AI_6
FLR1-AHU6
96.00
98
IBA1WFCNT
TOTAL DETECTED
509
IBA2WFCNT
TOTAL DETECTED
126
IBA3WFCNT
TOTAL DETECTED
0
IBA4WFCNT
TOTAL DETECTED
580
IBA5WFCNT
TOTAL DETECTED
61
IBA6WFCNT
TOTAL DETECTED
98
IBA7WFCNT
TOTAL DETECTED
868
IBA1WFTM1
TIME COUNTER
0
IBA4WFTM1
TIME COUNTER
0
IBA5WFTM1
TIME COUNTER
0
IBA6WFTM1
TIME COUNTER
0
IBA7WFTM1
TIME COUNTER
0
IBA1WFUOC
WIFI UNOCC MODE
OFF
IBA4WFUOC
WIFI UNOCC MODE
IBA5WFUOC
WIFI UNOCC MODE
OFF
IBA6WFUOC
WIFI UNOCC MODE
OFF
IBA7WFUOC
WIFI UNOCC MODE
OFF
IBA11WFUOC
WIFI UNOCC MODE
OFF
IBA21WFUOC
WIFI UNOCC MODE
OFF
IBA22WFUOC
WIFI UNOCC MODE
OFF
IBA23WFUOC
WIFI UNOCC MODE
OFF
IBA31WFUOC
WIFI UNOCC MODE
OFF
IBA11SF
North Lib S FAN
ON
IBA12SF
ASRS Vault S FAN
ON
IBA13SF
Special Coll S F
ON
South Lib S Fan
ON
IBA22SF
Lectur 182 S Fan
ON
IBA23SF
South Mtg Rms SF
ON
IBA31SF
Heritage Core SF
ON
IBA11DU
NONE
AUTO
IBA21DU
NONE
AUTO
IBA22DU
NONE
AUTO
IBA23DU
NONE
AUTO
IBA31DU
NONE
AUTO
N LIB N AHU11 TOI
Mode Output
OCC1
N LIB S AHU21 TOI
Mode Output
OCC1
N LIB S AHU22 TOI
Mode Output
OCC1
N LIB S AHU23 TOI
Mode Output
OCC1
N LIB S AHU31 TOI
Mode Output
OCC1
IBA11ZTA
AVG SPACE TEMP
22.8 DEG C
IBA21ZTA
AVG SPACE TEMP
23.1 DEG C
IBA22AT
AVG SPACE TEMP
21.6 DEG C
IBA23AT
AVG SPACE TEMP
22.1 DEG C
IBA31ZTA
AVG SPACE TEMP
23.5 DEG C
IBA11ZTMX
WARMEST RM TE
24.4 deg C
IBA21ZTMX
WARMEST RM TE
25.0 deg C
IBA22ZTMX
WARMEST RM TE
22.3 deg C
IBA23ZTMX
WARMEST RM TE
22.5 deg C
IBA31ZTMX
WARMEST RM TE
25.3 deg C
IBA11ZTMN
IBA21ZTMN
IBA22ZTMN
IBA23ZTMN
IBA31ZTMN
RTS

Average Daily Running Hours




I.K. Barber (2) - Elect Demand
Average Power (kW)
650
600
550
500
450
400
350
300
250
200
Oct 5
12:00pm
Oct 6
12:00pm
Oct 7
12:00pm
Oct 8
12:00pm
Oct 9
12:00pm
Oct 10
12:00pm
Oct 11
12:00pm
Oct 12


I.K. Barber (2) - Elect Demand
Average Power (kW)
600
575
550
525
500
475
450
425
400
375
350
325
300
275
250
225
200
175
Nov 2
12:00pm
Nov 3
12:00pm
Nov 4
12:00pm
Nov 5
12:00pm
Nov 6
12:00pm
Nov 7
12:00pm
Nov 8
12:00pm
Nov 9


100%
90%
80%
70%
60%
50%
40%
12 AM
6 AM
12 PM
6 PM
Before
After


I.K. Barber (2) [WIFI BL] - Elect CUSUM
Energy (kWh)
60,000
55,000
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
-5,000
Sep 8
Sep 22
Oct 6
Oct 20
Nov 3
Nov 17
Dec 1
Dec 15
Dec 29
Jan 12
Jan 26
Feb 9
Feb 23

Challenges

- Highly complex pathway to implementation
- Consistency of data
- Successful data transfer does *not* guarantee savings
- Principal-agent problem

Moving Forward

- Next version
- Better data
- More rollout
- Alternative logic

Other Possible Uses

- Asset management
- Emergency Response
- Security Services

a place of mind

THE UNIVERSITY OF BRITISH COLUMBIA

UBC100