

Energy in supermarkets

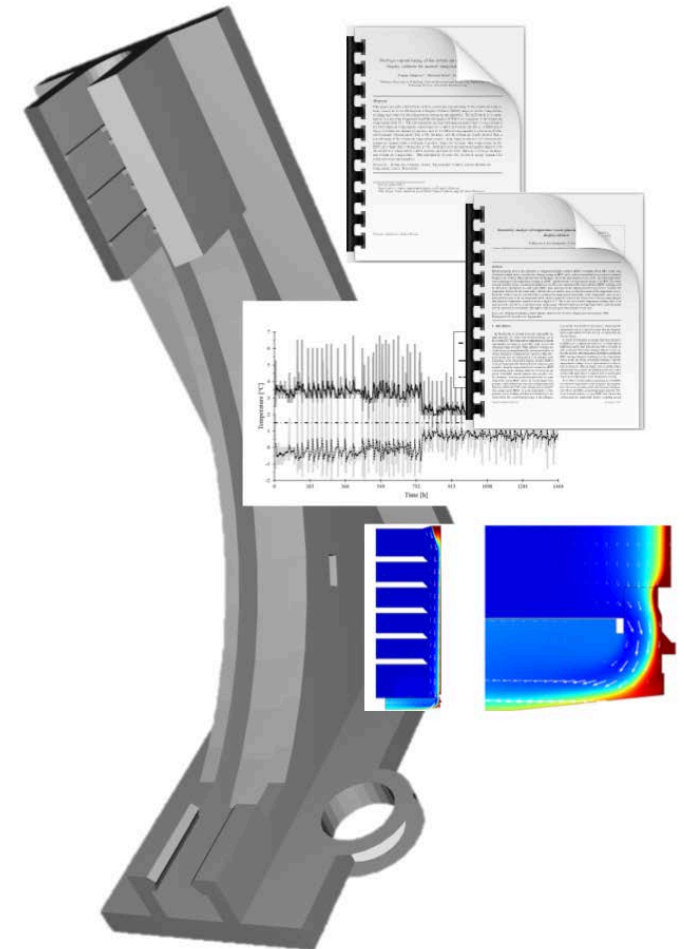
-Our current research and a brief outlook

Tommie Månsson
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Agenda

- **Intro – Tommie**
- **Intro - What is a supermarket?**
- **Project – SensorHolder**
- **Project – Energy Forecasting and Door openings**








- **Outlook, questions and discussion**

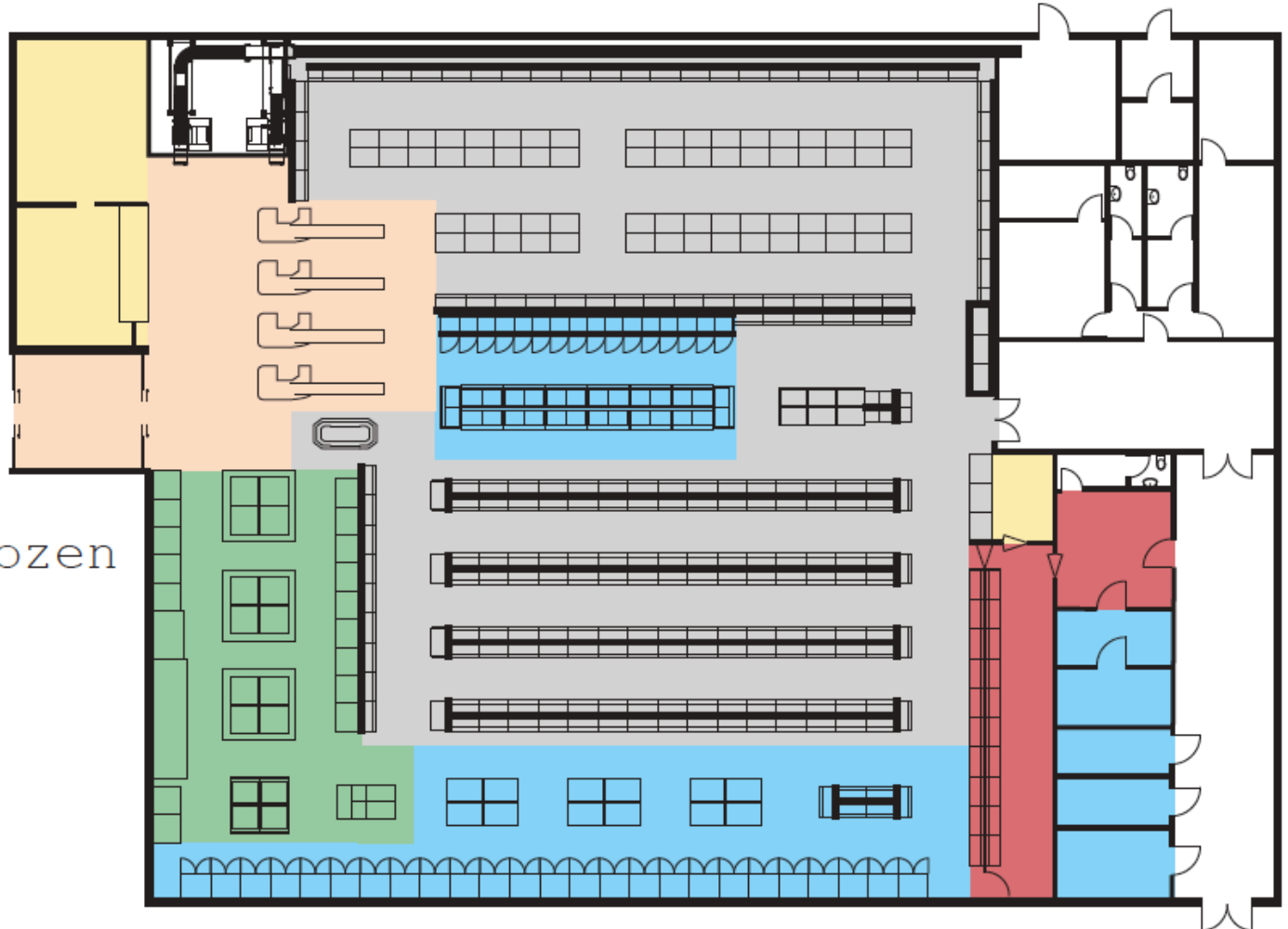


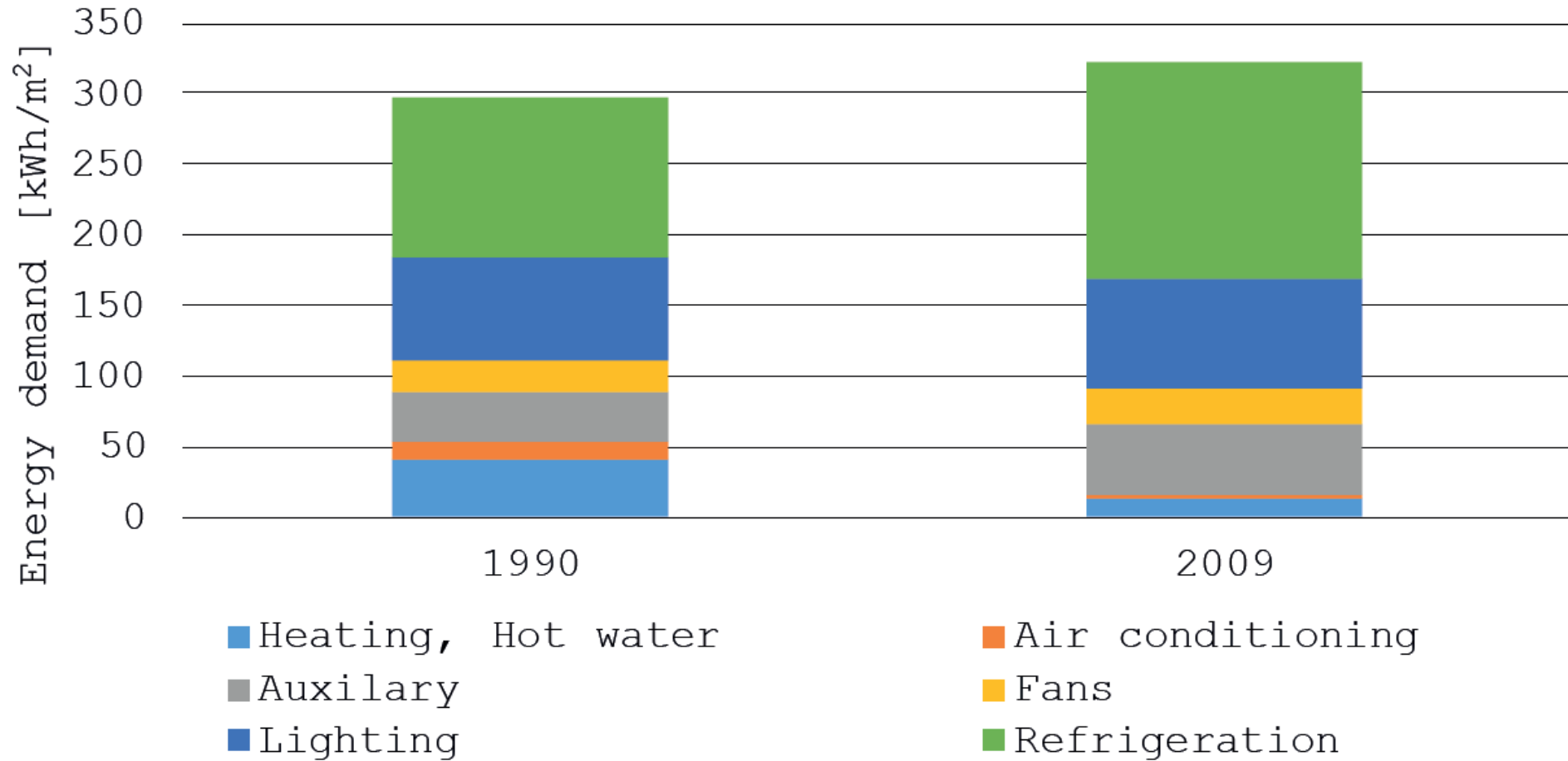
Energy in supermarkets

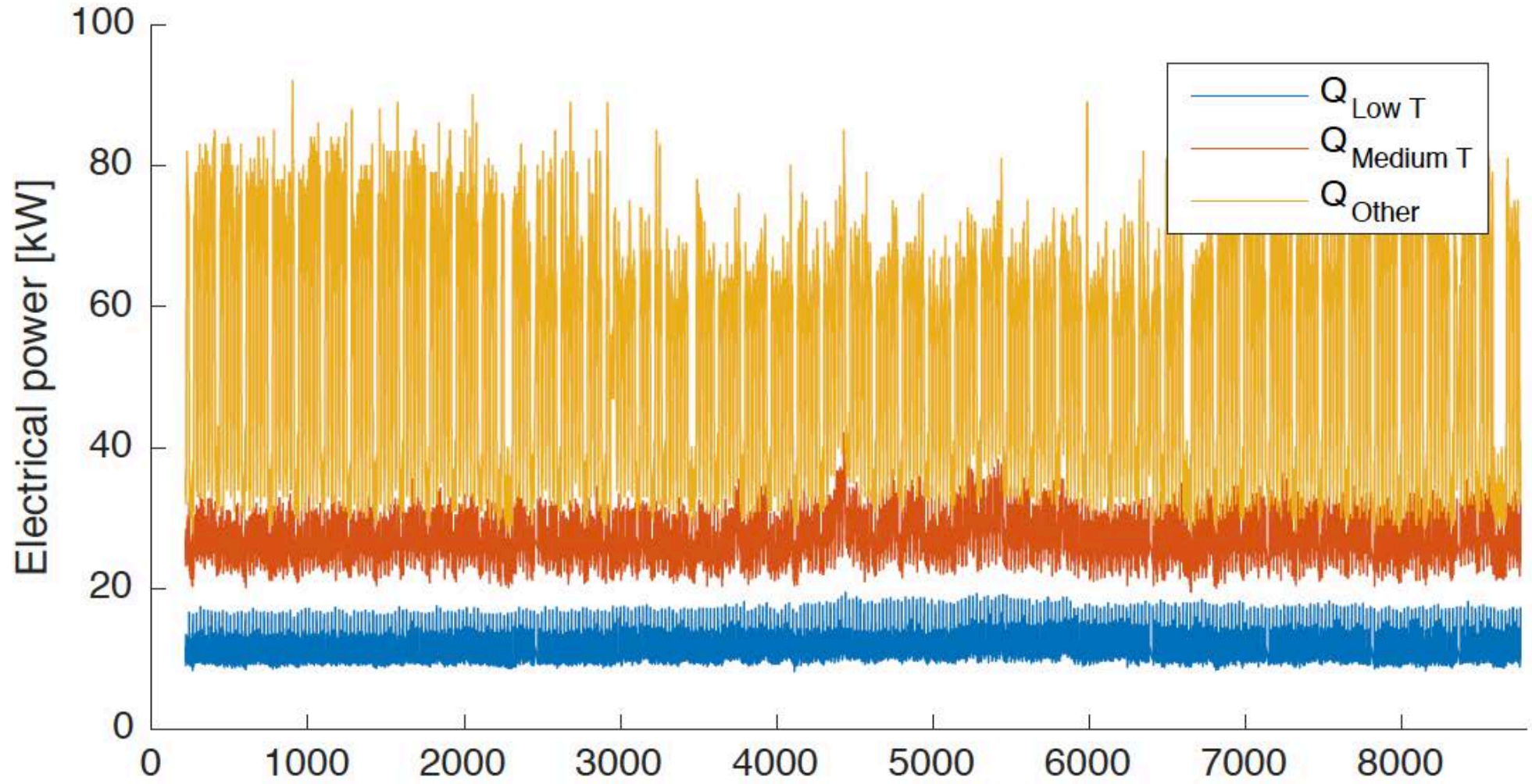
-Our current research and a brief outlook

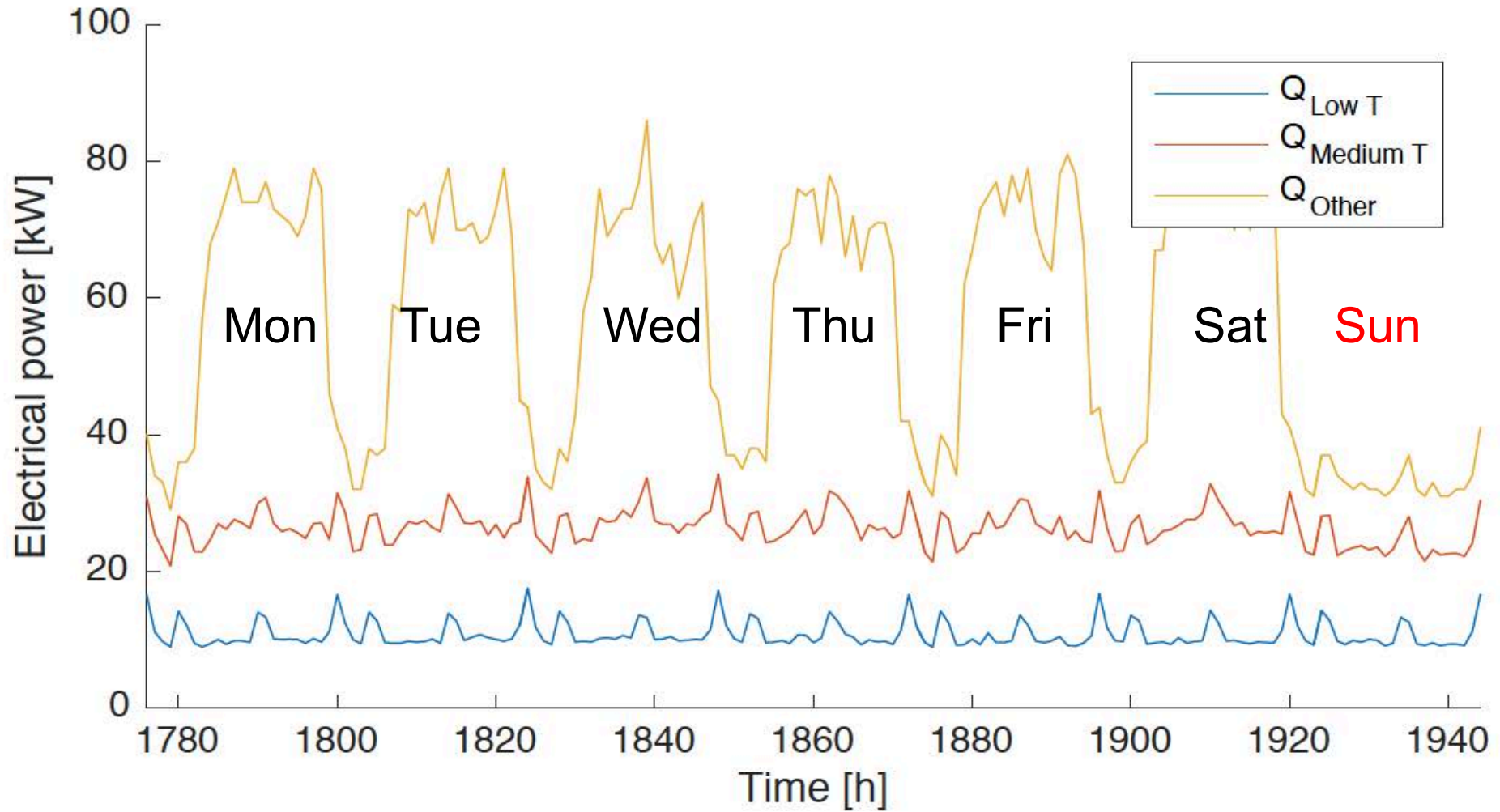
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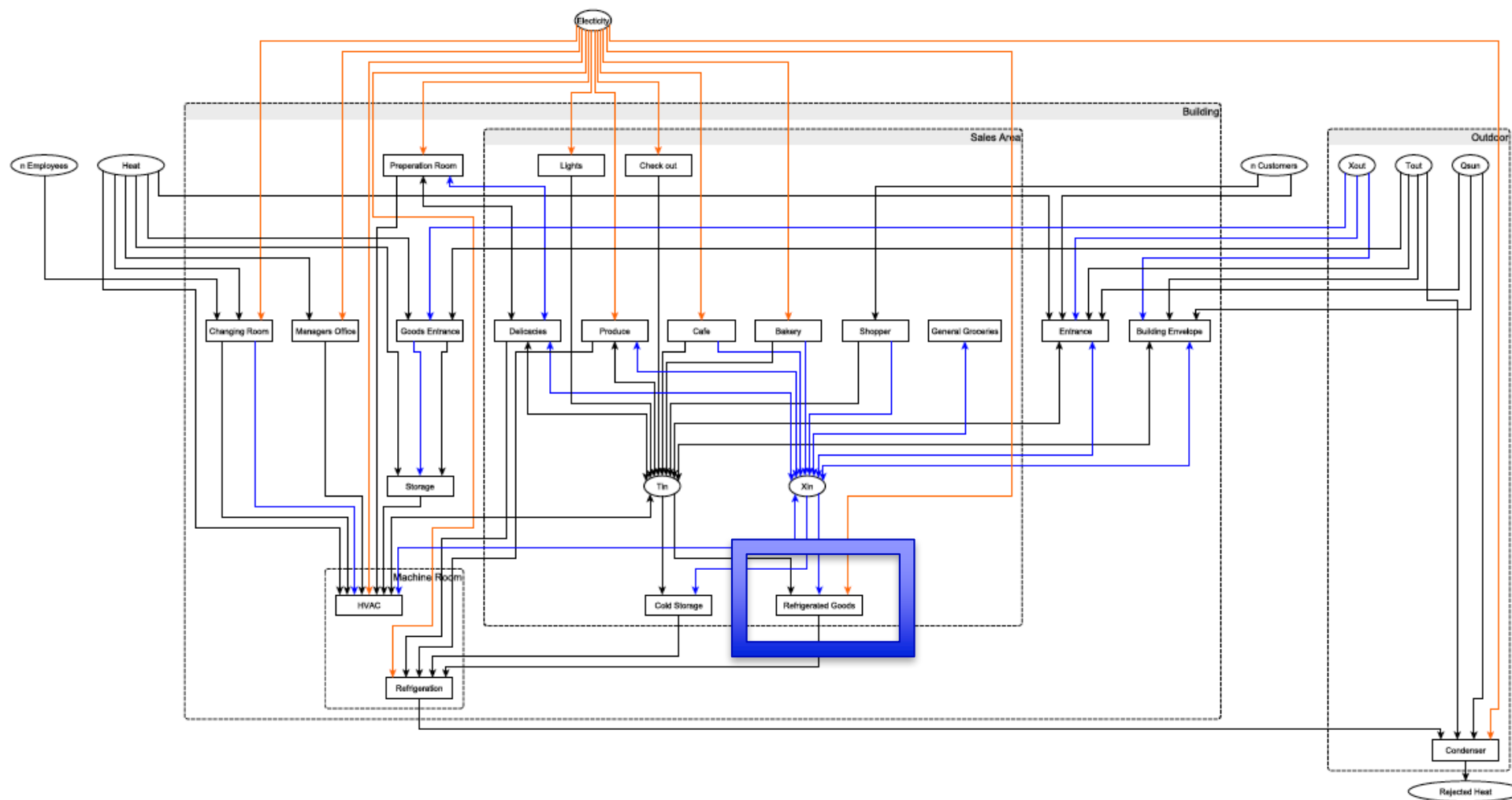
-  Check out
-  Produce
-  Refrigerated / Frozen
-  Bakery / Café
-  Delicacies
-  Drygoods
-  Other

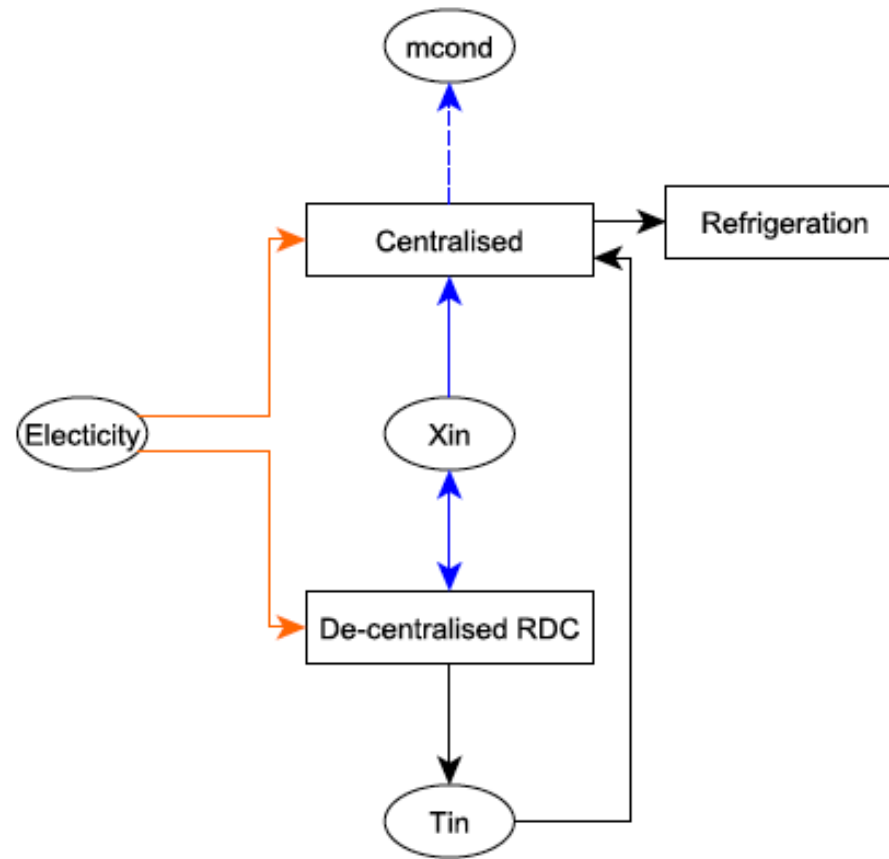


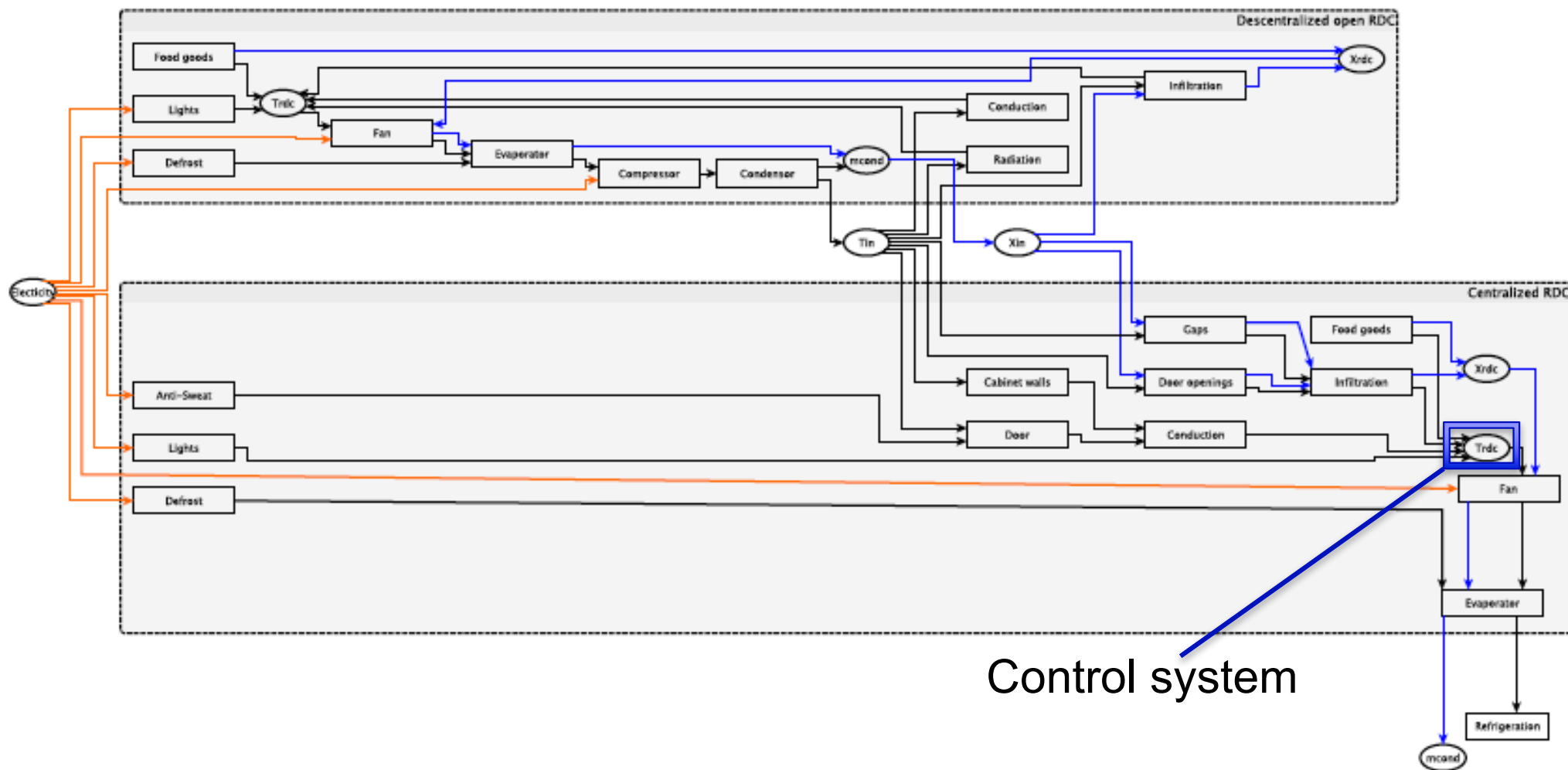


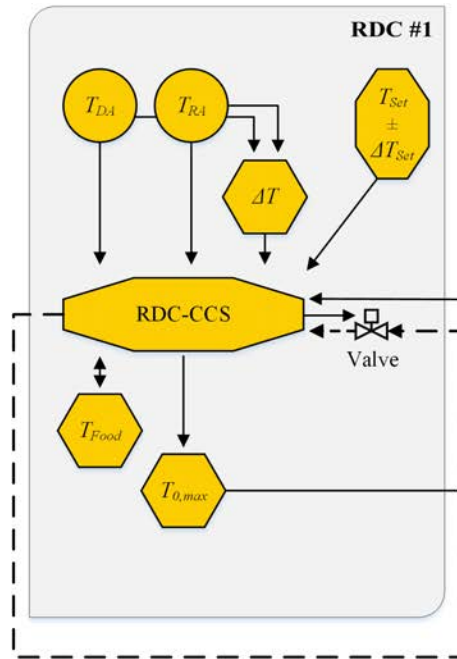
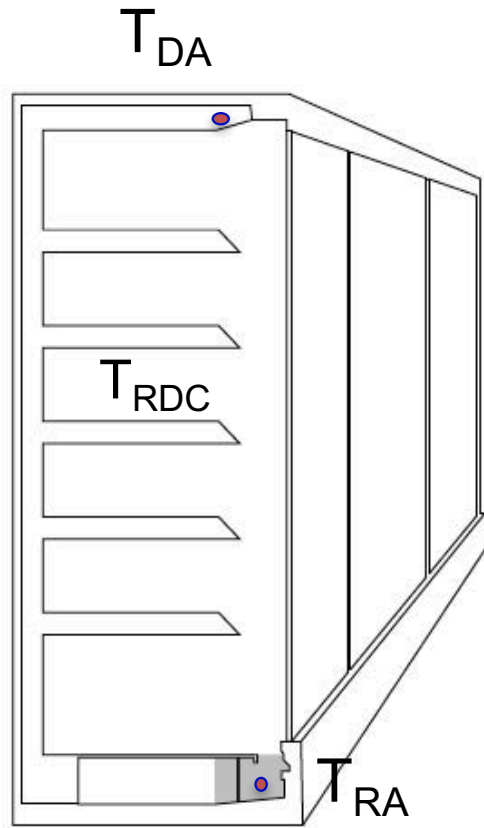




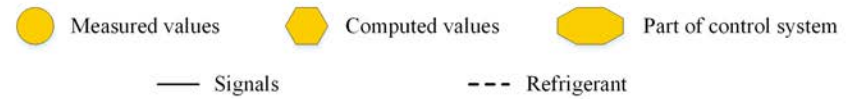


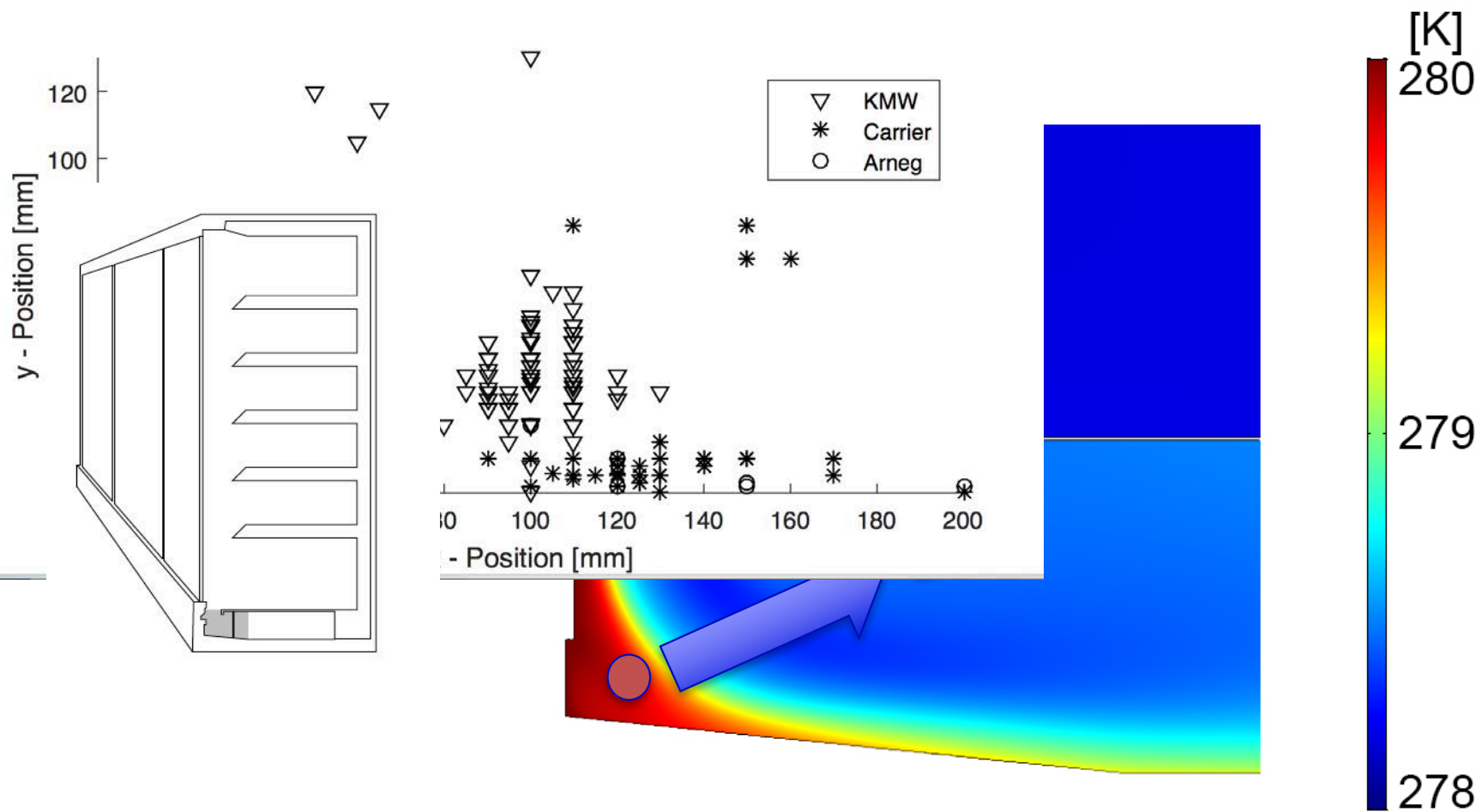


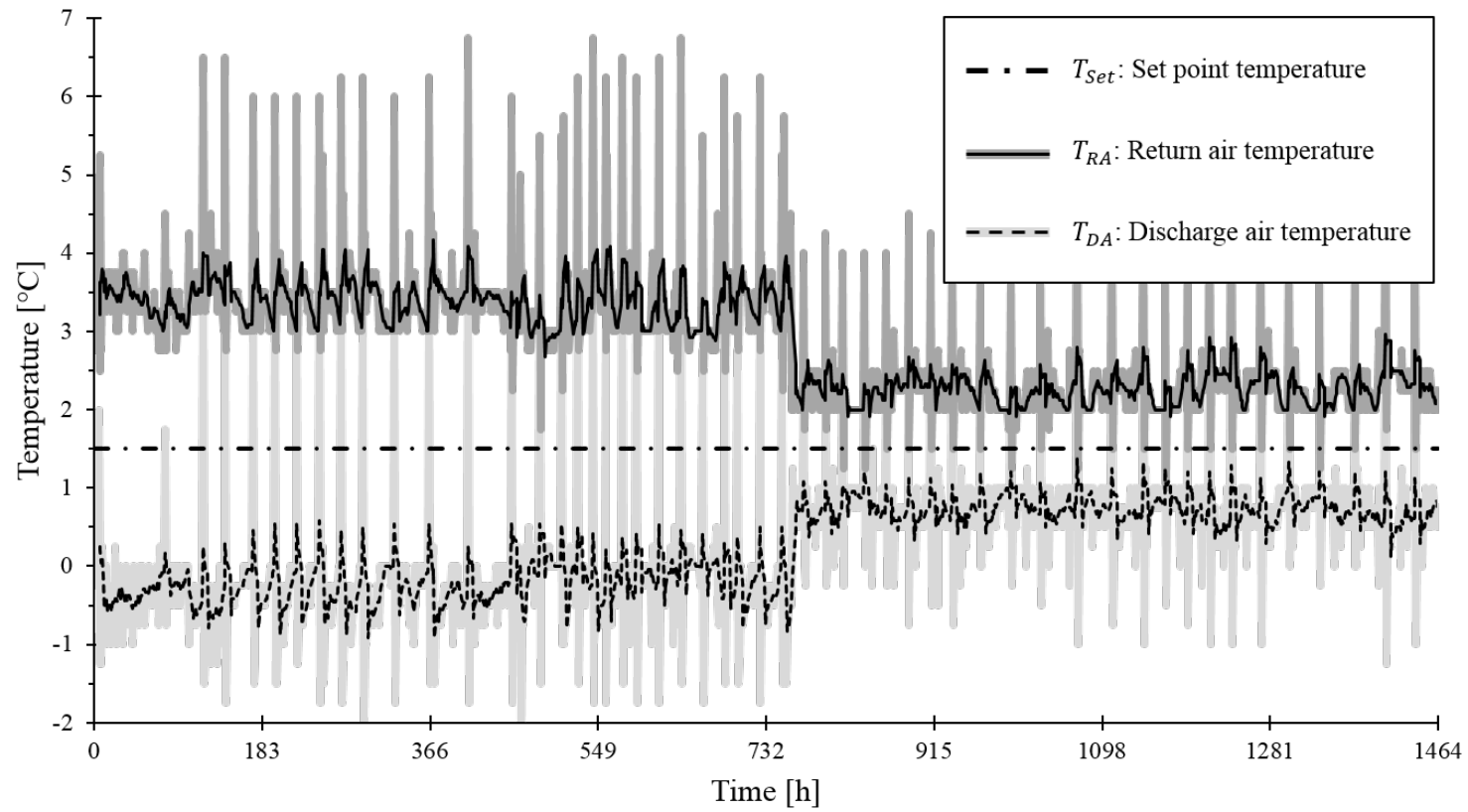


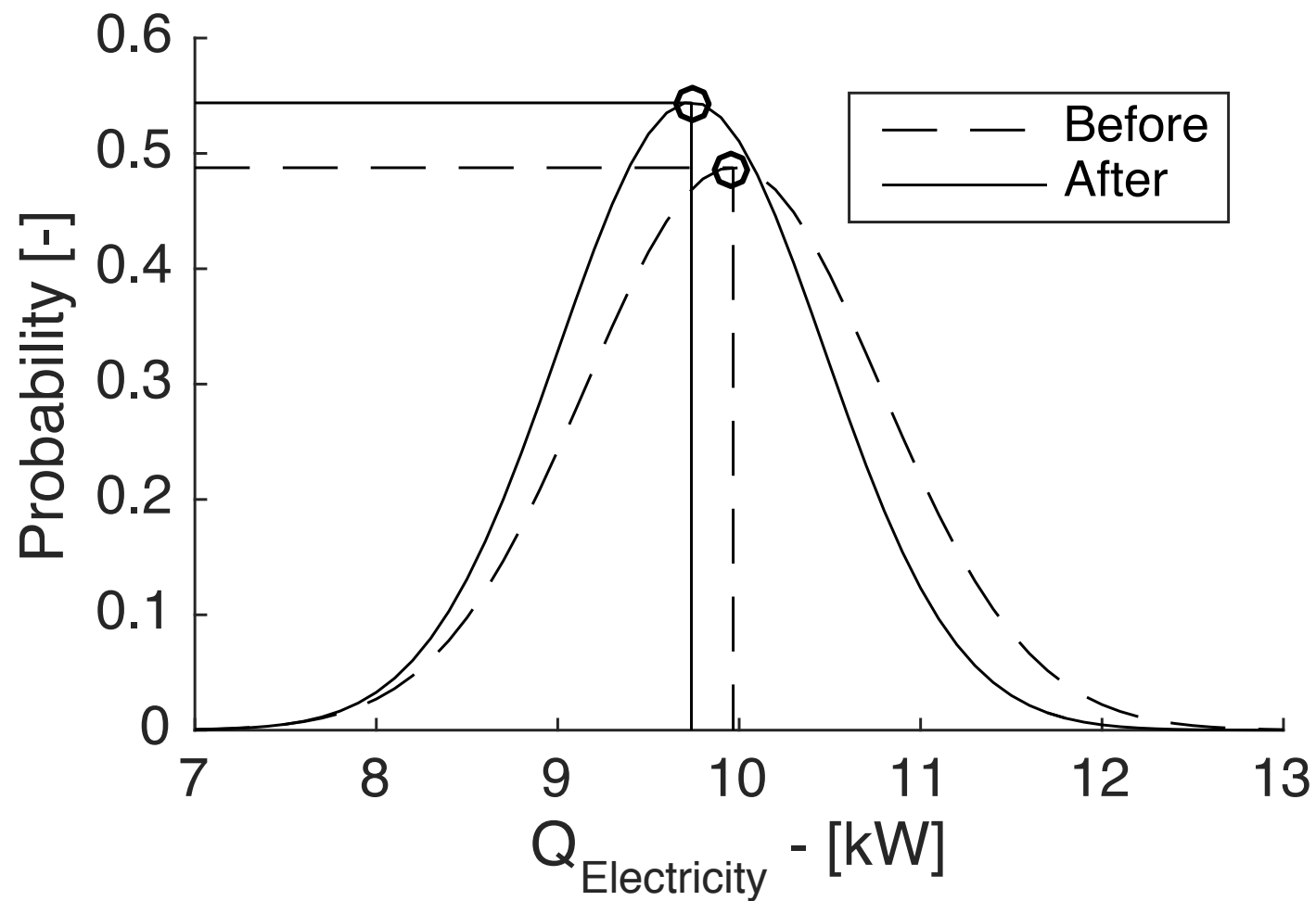


$$T_{RDC} = (T_{DA} + T_{RA}) / 2$$









News & Events

Latest news

Upcoming events



How some smart guys cool down the energy consumption in supermarkets

19 April 2017

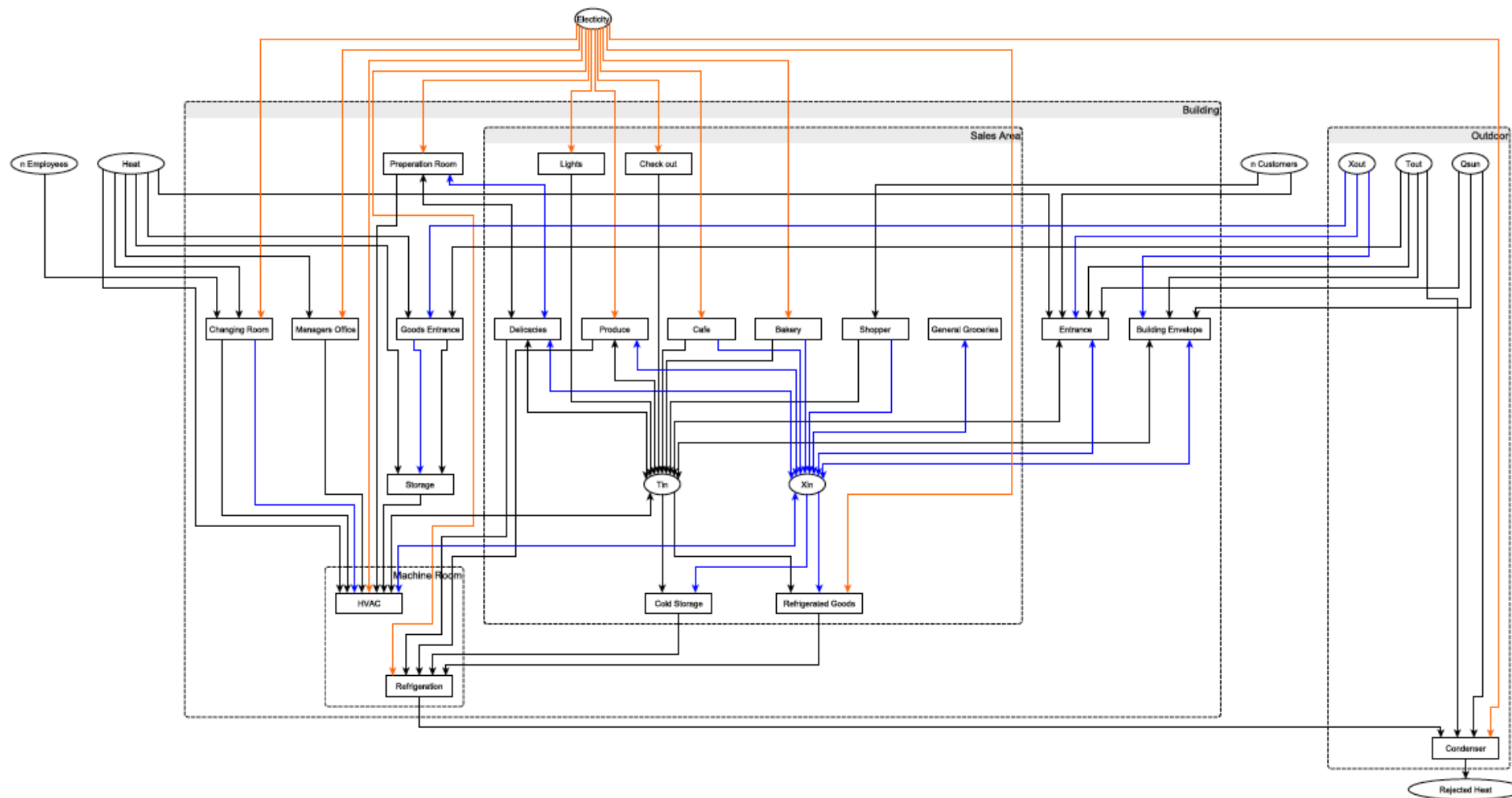
Refrigeration is one of the main drivers in supermarkets energy consumption, almost 50 % of the total. Almost 10 years ago, 2 guys started to ask questions about this consumption: How do you deal with internal heat within a supermarket? How much is this amount of heat? Where is the energy wasted and how could this be changed? This genuine interest was the start of a unique relationship between York Ostermeyer, at that time postdoc at ETH Zürich, his team and the REWE supermarket chain in Northern Germany.

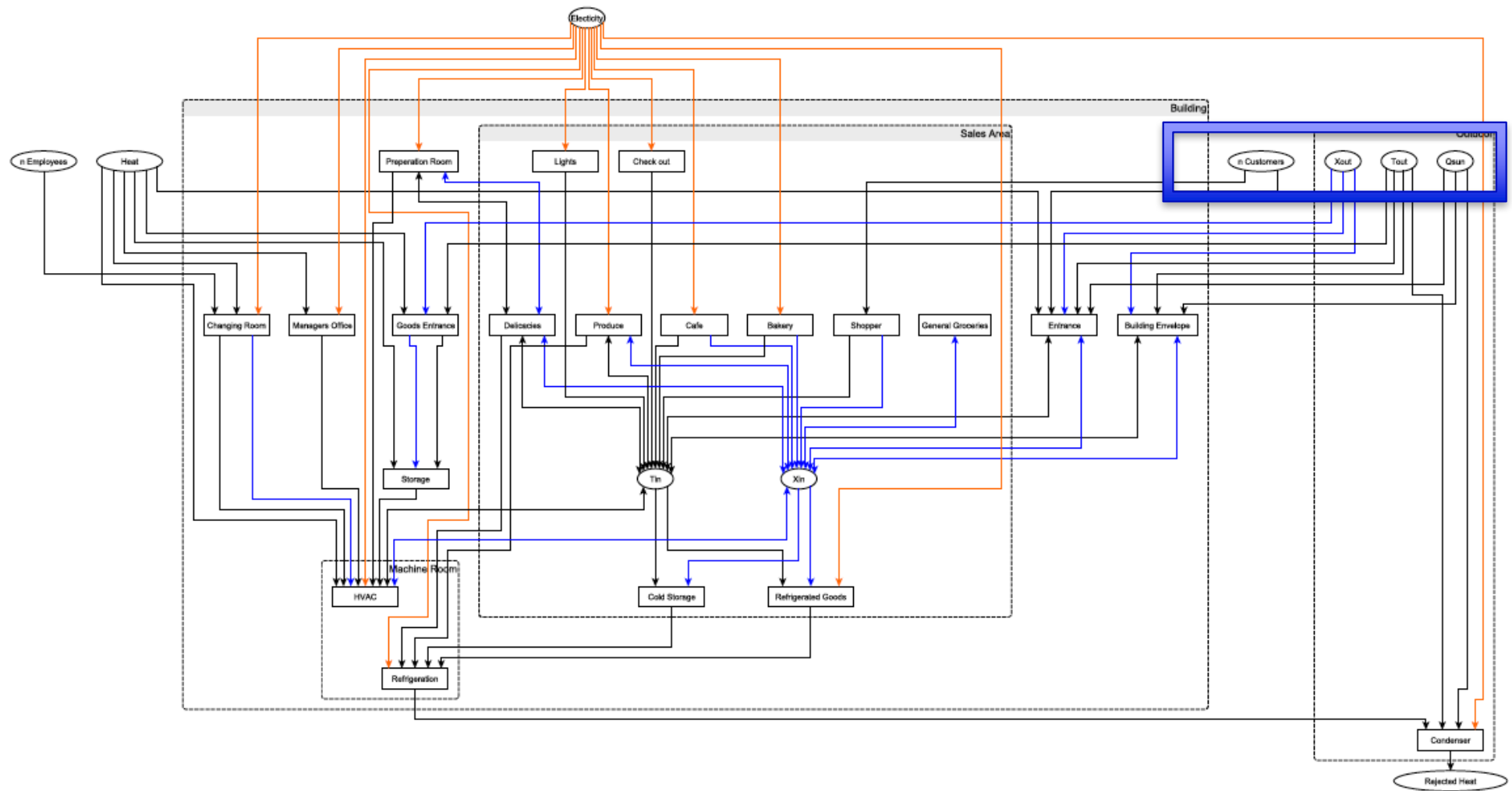


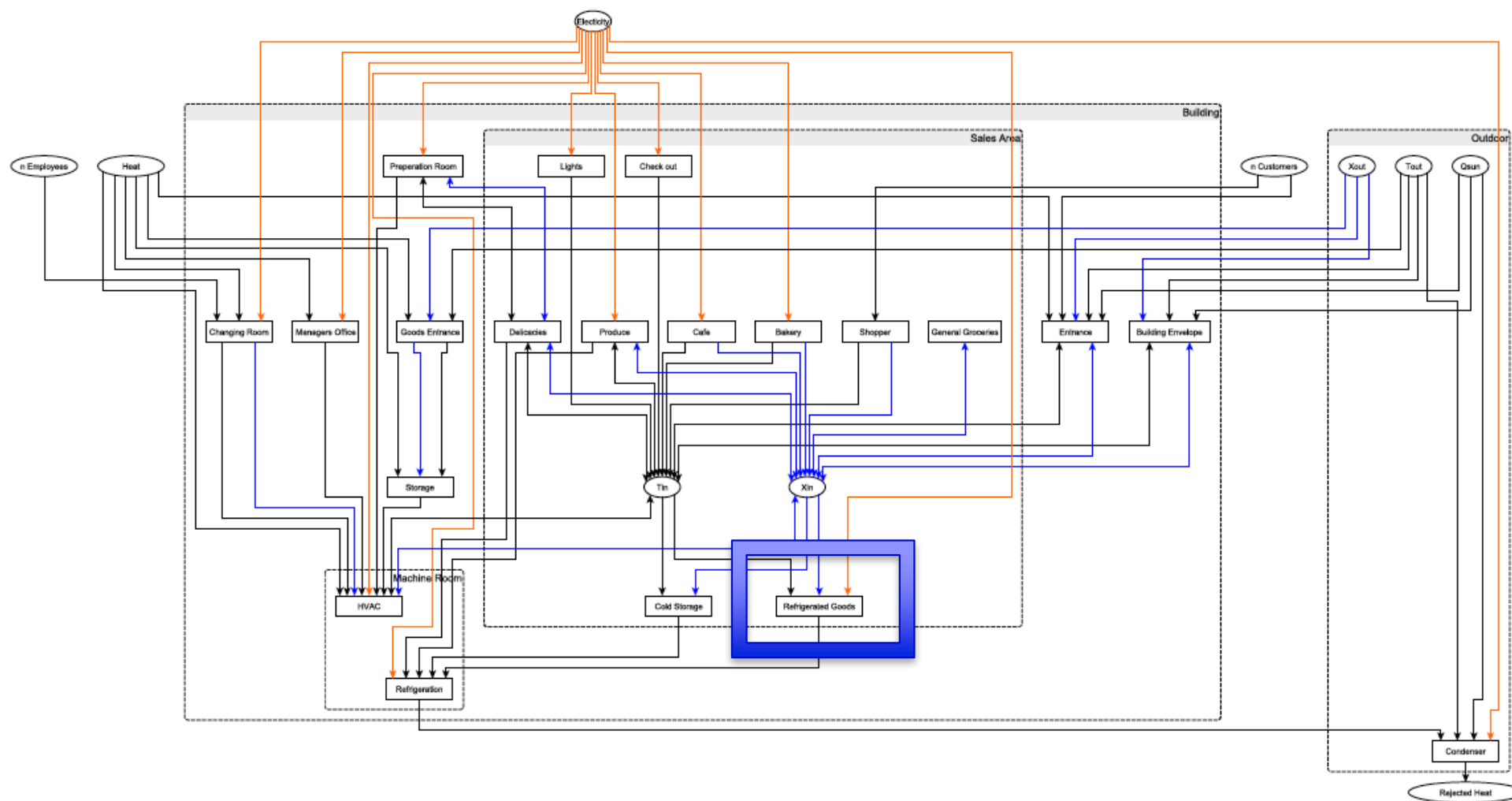
Building Solutions Services
Cooling Germany GmbH

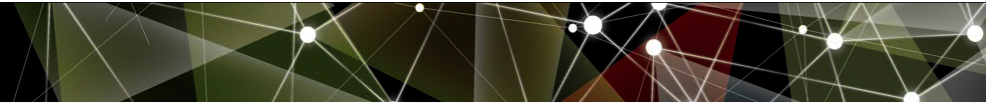
Collaboration with ICT

- Energy forecasting model
- Track the opening of doors









Collaboration with ICT

- Energy forecasting model
- **Track the opening of doors**



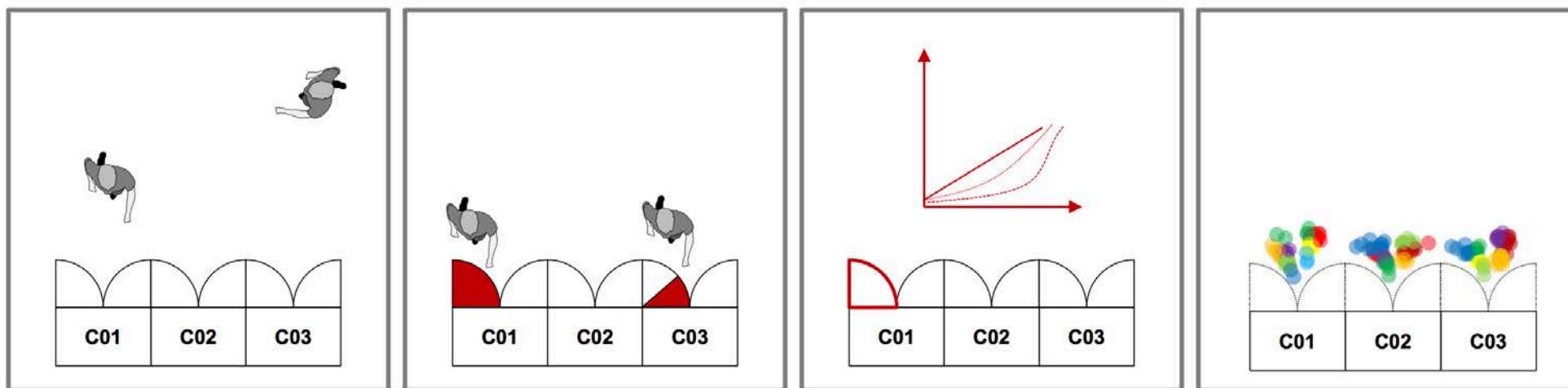
MxEasy dhcp2-172050.bt.chalmers.se
95.1 lux
18 Hz
187100

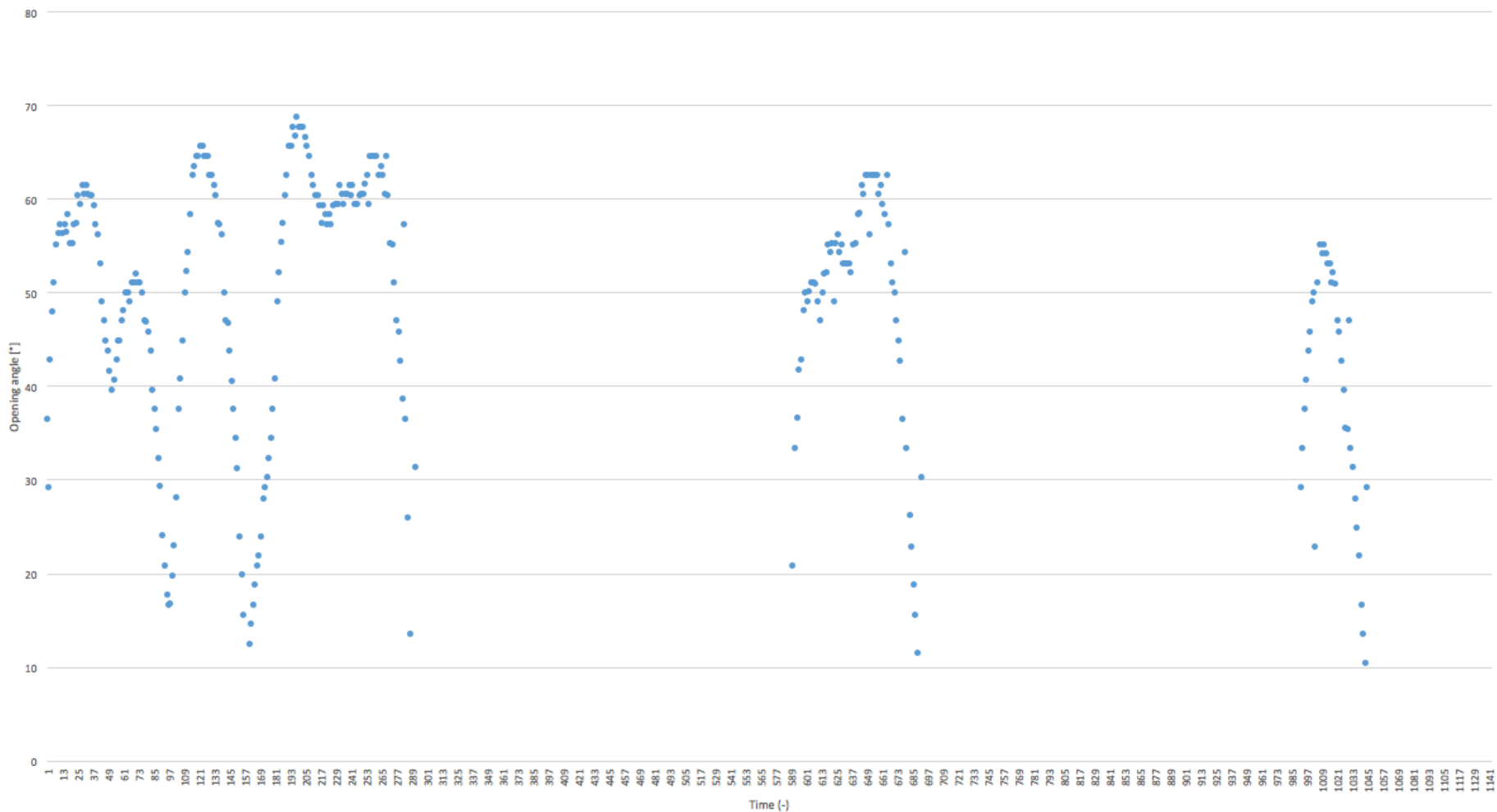
2016-04-07 09:18:50.380



988873 UM

(UA) FR88 REC

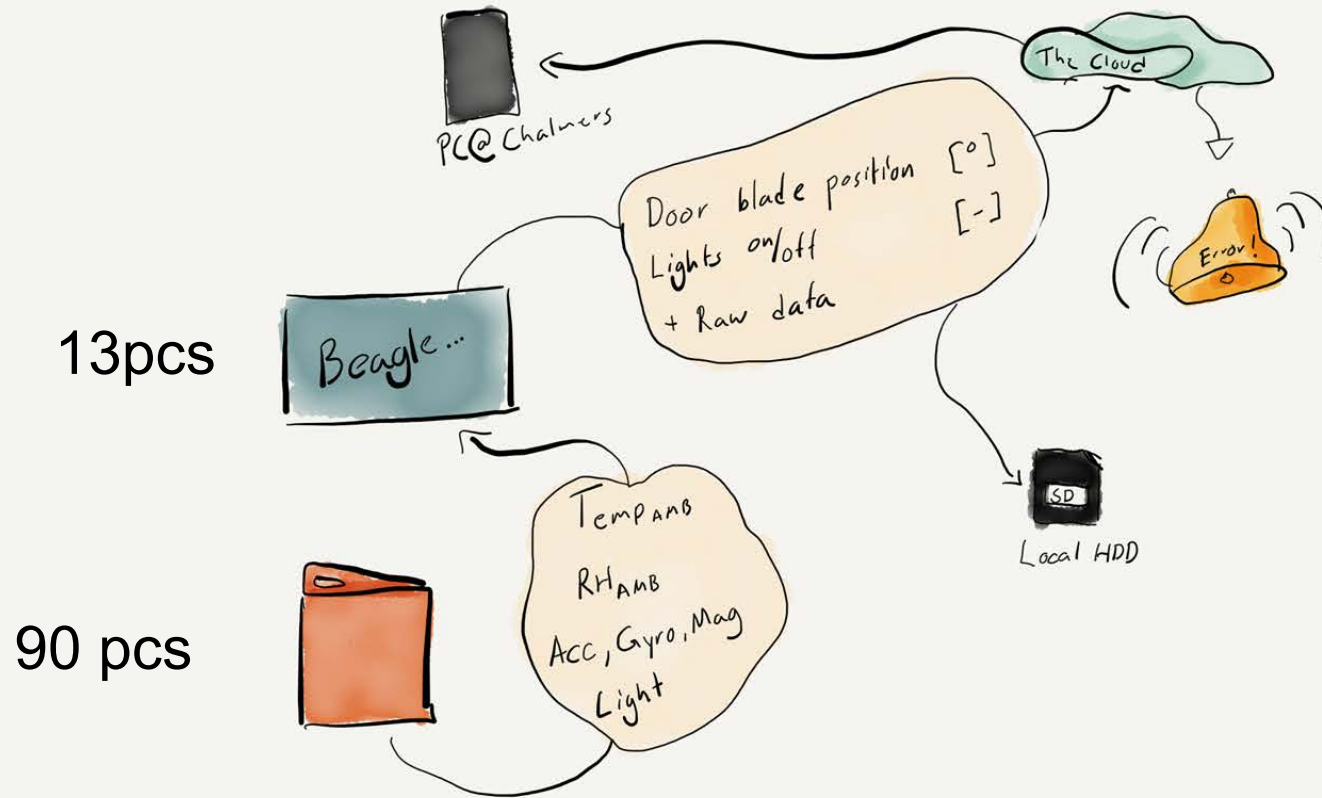


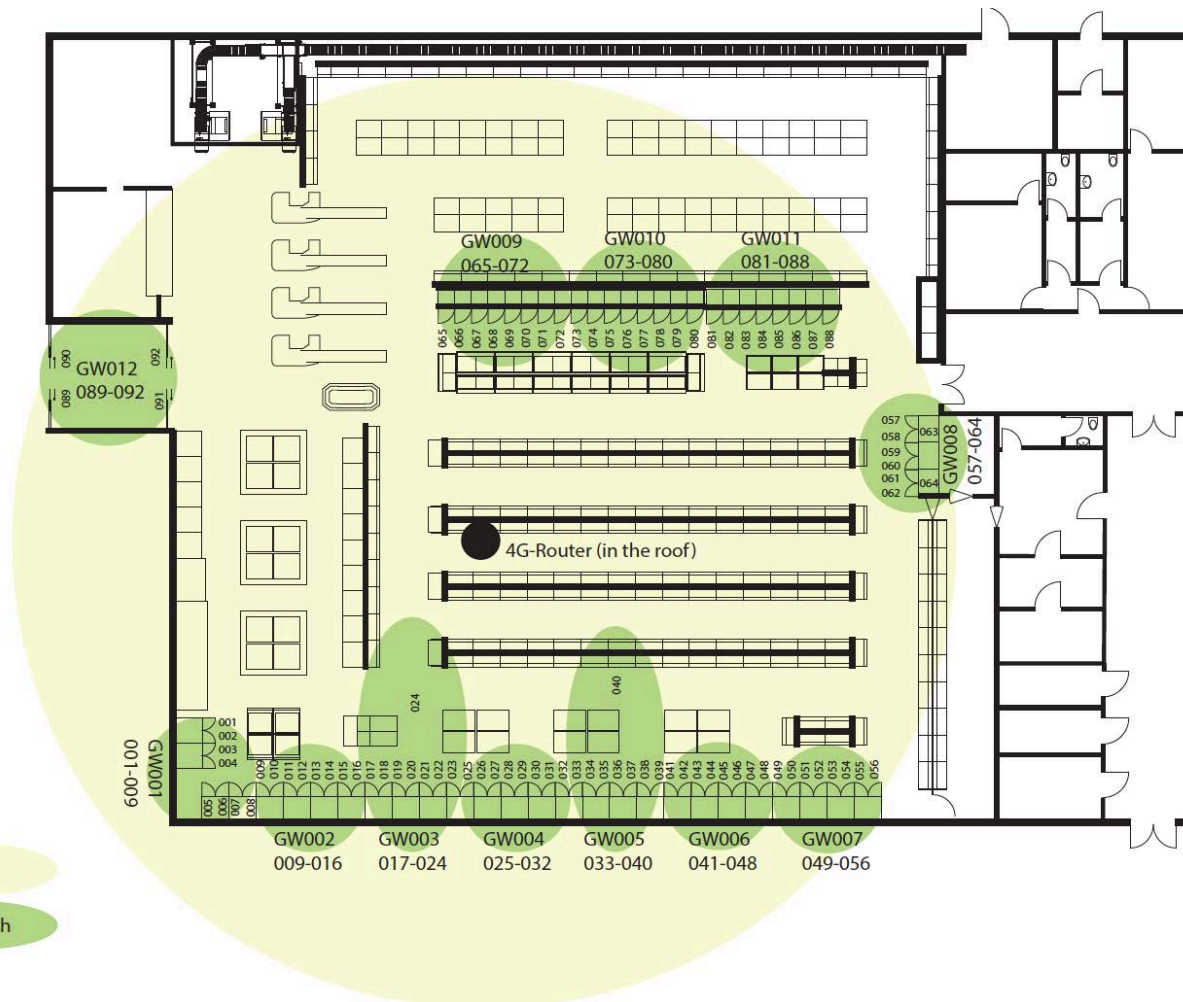






	Bluetooth low energy	BLE + Sub-1 GHz	6LoWPAN	ZigBee	Wi-Fi
Price	\$29 Buy now	\$29 Buy now	\$29 Buy now	\$29 Buy now	\$39 Buy now
Battery type	Coin cell	Coin cell	Coin cell	Coin cell	AAA
Connects to Internet	Smartphone	Smartphone	BeagleBone gateway	BeagleBone gateway	Directly
BLE Beacon support	✓	✓			
DevPack support	✓	✓	✓	✓	
Mesh network			✓	✓	
Range	50m / 150ft	100m/300ft(Bluetooth), 2 km(Sub-1GHz)	100m / 300ft (extended with mesh network)	100m / 300ft (extended with mesh network)	100m / 300ft
Max number of devices	8	8	200	200	64, varies by Wi-Fi router
Battery lifetime*	1 year (1 second report interval)	1 year (1 second report interval)	1 year (1 second report interval)	1 year (1 second report interval)	3 months (1 minute update interval)
User Interface	App	App	App, Web	App, Web	App











Message

Meeting Attachment Move Junk Rules Read/Unread Categorize Follow Up

First data from door opening study

CM
Christian
Tuesday, 8 August 2017 at 07:30
To: [redacted]
Cc: [redacted]

Hej Adones.

I uploaded all data that I copied manually at the store to [redacted]. You will find some unnamed pictures in the folders. These are screenshots to show the original "last edit dates" of the files on the beaglebones.

To summarize my observations:

- Beaglebone nr. 3 was very slow ... losing connection all the time. The uploaded data (@BOJ) is not complete due to that.
- Beaglebone nr. 13 showed up, but connection could not be established. No data.
- Beaglebone nr. 6 and nr. 12 did not show up at all, saying they lost connection to the routers. No data.
- I pushed the ON button on some sensors. One LED started blinking, many of them did not.
- 3 sensors that we placed on the entrance doors are missing. (I have not had the chance to talk to the market manager to check if he removed them.)
- Most data files had the "last edit date" **August 2nd**, but all at different times (hh:mm, check screenshots) which indicates to me it was not a power loss of the beaglebones that made them stop reporting.
- It could be the battery of the sensor itself. If so, it worked for approx. 2 days ... we definitely need another (more power saving) setting since I will not be able to change batteries that often ... especially if we then have to run the same registration process we had to do on 31st of July – it took more than 4 hours.
- I could not measure the batteries since I did not bring a voltmeter. I hope you can read out a potential voltage drop in the log files.
- In total the approx. 2 days of measuring created about 1,900 files with a total size of 1.4 GB which would lead to approx. 21 GB per month.
- The remote access to the routers and from there to the beaglebones still seems to be a problem that does not allow remote download of data. The manual download at the store took 1.5 h due to connection problems to some of the 12 beaglebones. If the connection can be established fast, it will take approx. 6 min per beaglebone to download data of 2 measurement days.

Please check the data and let us then decide how to move on. First thing to do might be to look into a "wake up when moved function" for the sensors to save battery. Who will buy new batteries in case I have to replace them?

Best regards,
Christian

Laser Zentrum Hannover e.V.
Dr. Christian Marx

Re: Adones flight details etc. 2017-07-27 Mobile: 0176 - 21057999

Merged Collected data phase 1

Search Sheet

Insert Page Layout Formulas Data Review View

Calibri (Body) 11 A A

Wrap Text

General

Normal Bad Good Neutral Calculation

Check Cell Explanatory... Input Linked Cell Note

Insert Delete Format

AutoSum Fill Clear

10		11		12		13		14		15	
X axis	Time	X axis	Time	X axis	Time	X axis	Time	X axis	Time	X axis	Time
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Print

Printer: sb1-k492-color1

Presets: Default Settings

Copies: 1 Two-Sided

Pages: All

Paper Size: A4 210 by 297 mm

Orientation: Excel

Print: Active Sheets

Margins: Normal Margins

Scale to fit: 1 pages wide by 1 (pages tall)

1 of 151 920

PDF Hide Details

Cancel Print

31		AC	AD	AE
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31_14-24-5	0,5	31_14		
31_14-24-5	-0,7	31_14		
31_14-24-5	-2,2	31_14		
31_14-24-5	0,2	31_14		
31_14-24-5	0,2	31_14		
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31_14-24-5	-0,9	31_14		
31_14-24-5	-1,3	31_14		
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31_14-24-5	-0,9	31_14		

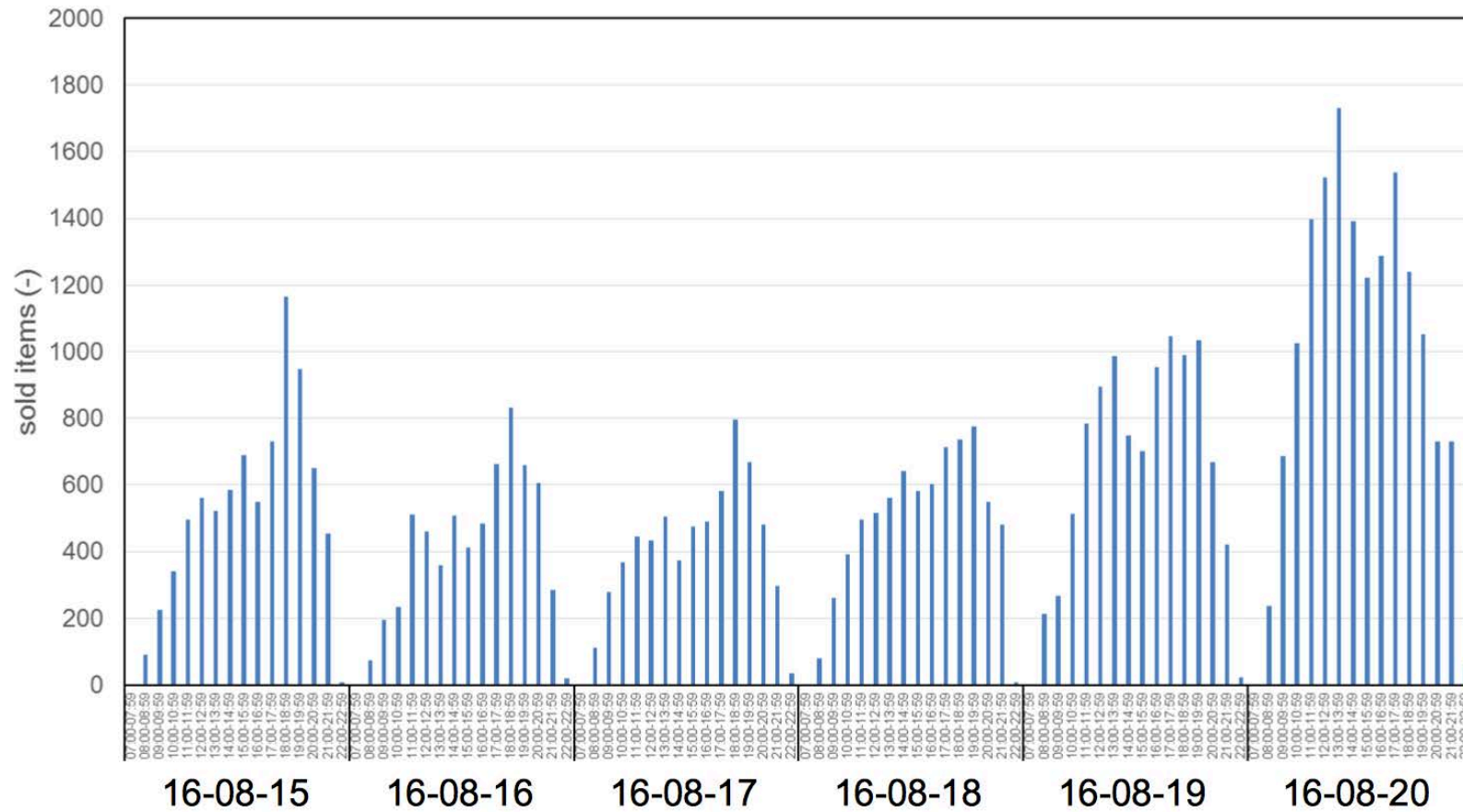
Revise and collect new data

- Save energy...
- Communication
 - ZigBee®/6LoWPAN /Bluetooth
- What to measure?
- Lost sensors...

Outlook

- **Forecast the energy demand**
 - **Time**
 - **Sales**
 - **Parking lot**
 - **???**

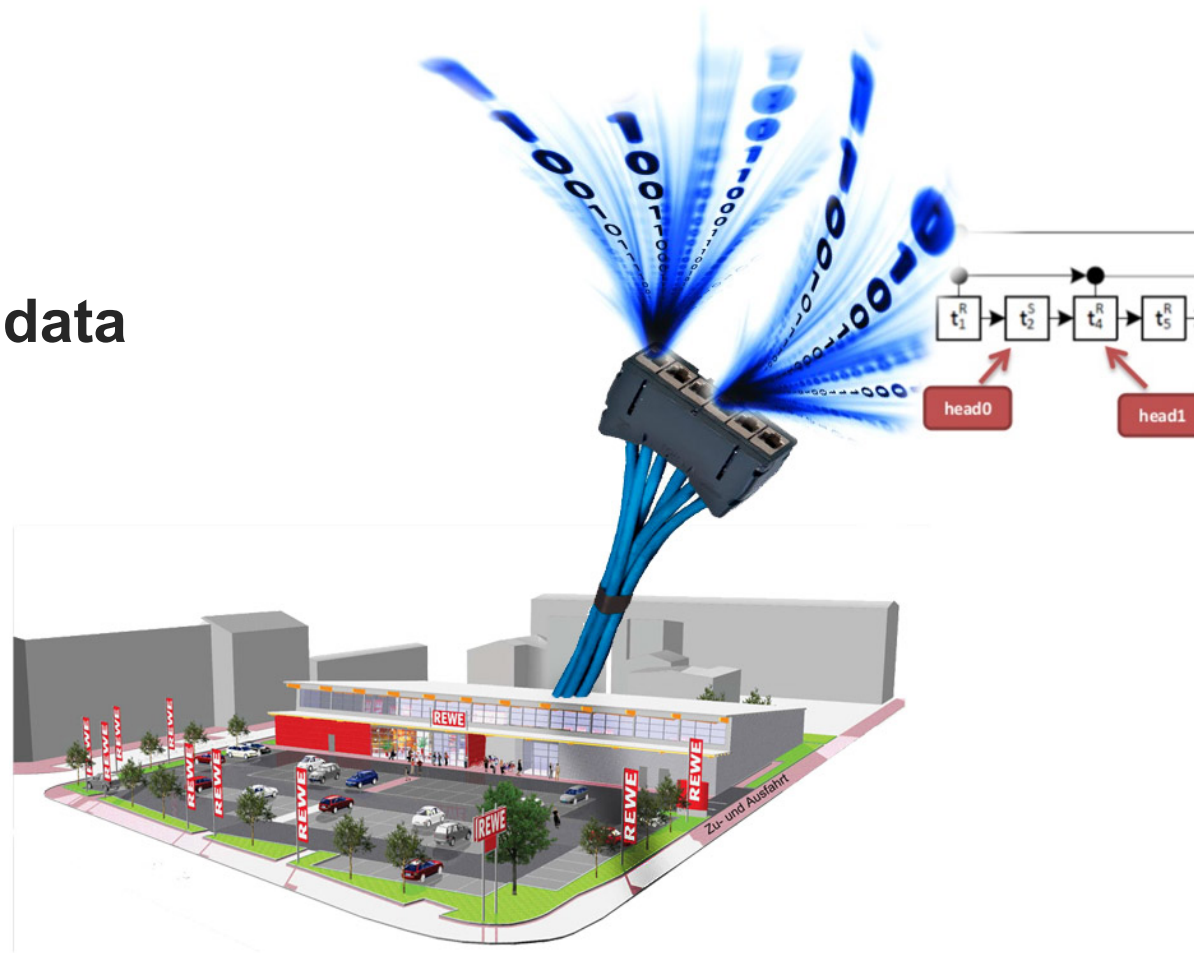
SOLD REFRIGERATED GOODS





Conclusion

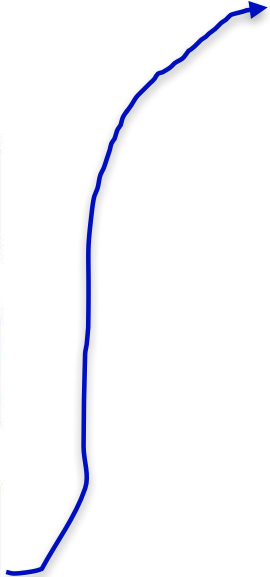
- “Humongous” amounts of data
- Forecast energy demand.
 - Predict what?
- Need of ICT collaborations



What to do with all this?

Questions?

This block contains a 3x3 grid of presentation slides. The top row includes a title slide, an agenda slide, and a subtitle slide. The middle row features three data visualization slides: a bar chart, a stacked bar chart, and a line graph. The bottom row contains three more data visualization slides: a line graph, a network diagram, and a flowchart.



This block contains a 6x3 grid of presentation slides. The slides include: a data table, a bar chart with a legend, a heatmap, a line graph with multiple series, a graph of a bell curve, a slide titled 'Collaboration with ICT' with bullet points, a photograph of a supermarket interior, a bar chart, a floor plan, a 3D model of a red cube, a flowchart, a photograph of a person in a supermarket, a screenshot of a software interface, a slide titled 'Review and collect new data' with bullet points, a photograph of a person in a supermarket, a screenshot of a software interface, a slide titled 'Outlook' with bullet points, a bar chart, and a line graph.

This block shows a tilted stack of presentation slides. The top slide is titled 'Questions?'. Below it is a slide titled 'Conclusions' with bullet points. The bottom slide is a data visualization slide.

