

IIoT Applied: 10 Things We Learned While Deploying an IIoT Machine Learning System

October 15, 2014

Strata NY

Cameron Turner



THE
DATA
GUILD

Who are we?



Who are we?



[Home](#) [People](#) [Process](#) [Blog](#) [Events](#) [Contact](#) | 

PRINCIPALS



Chris Diehl



Chris has extensive experience defining and developing analytics for a variety of



David Gutelius



David previously drove data science and technology innovation at Jive Software as



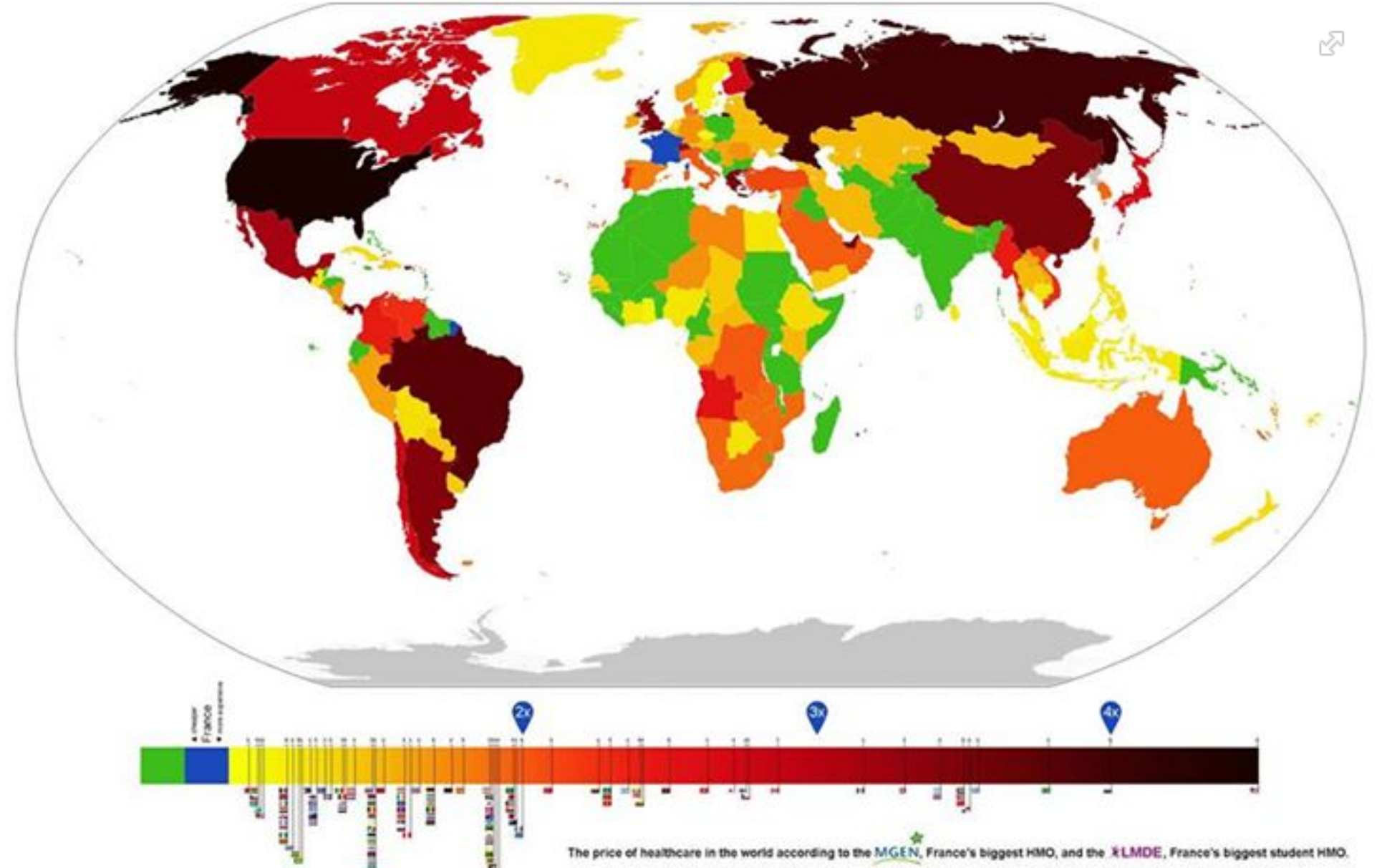
Cameron Turner



Combining an extensive background in product research, data analysis, program







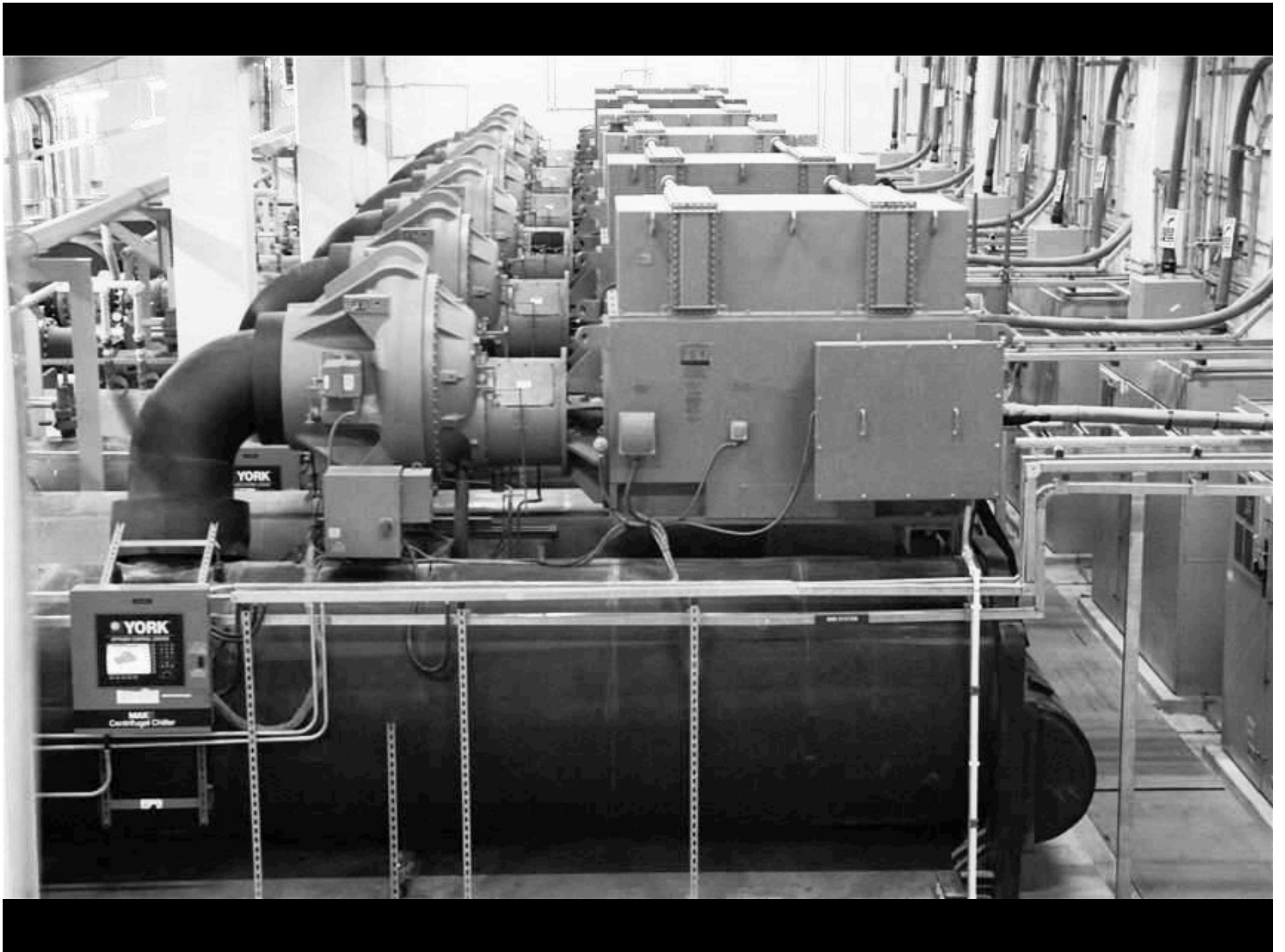
Credit: Data Science Central



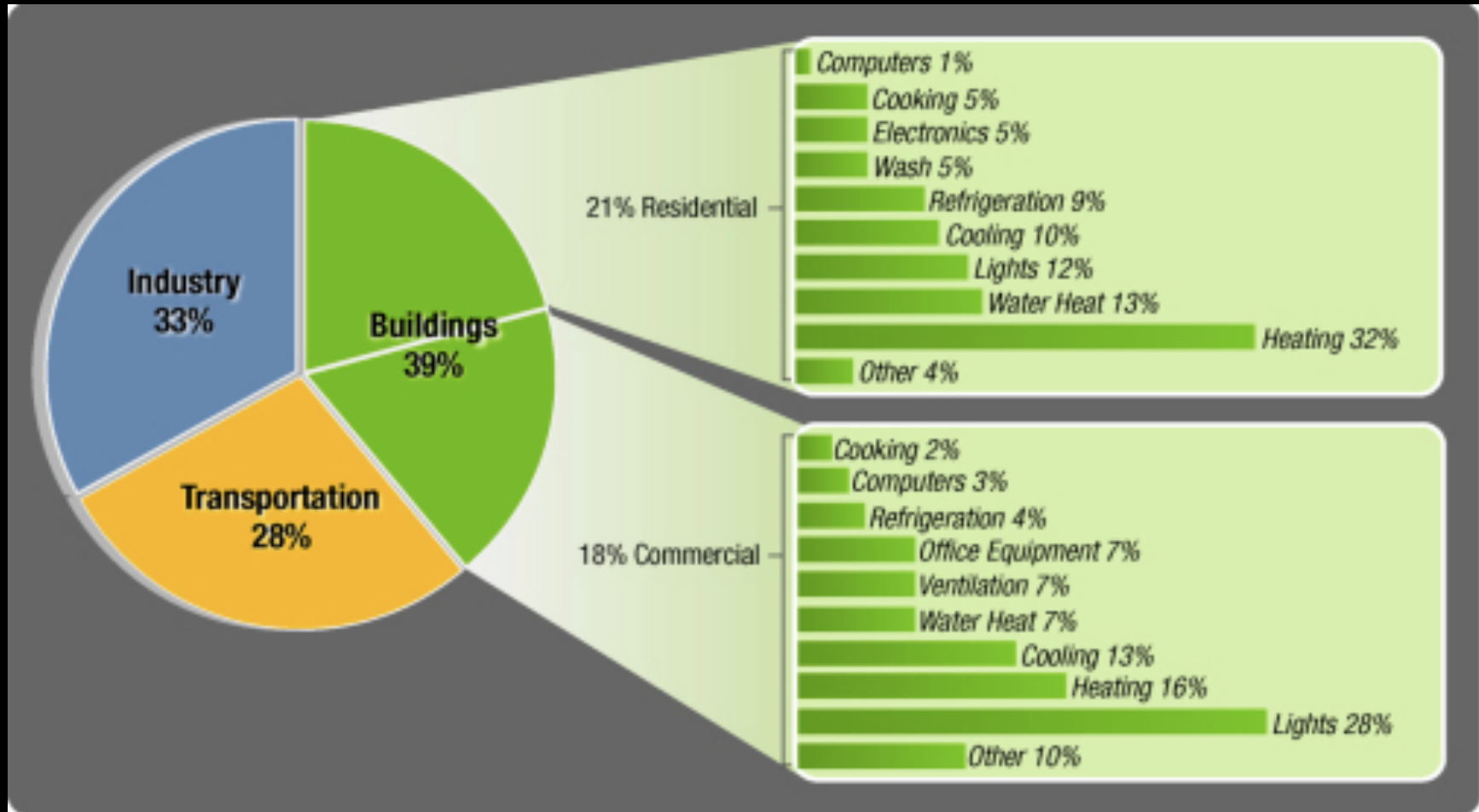


Lesson #1: Challenge Broadly Held Beliefs/Industry Assumptions



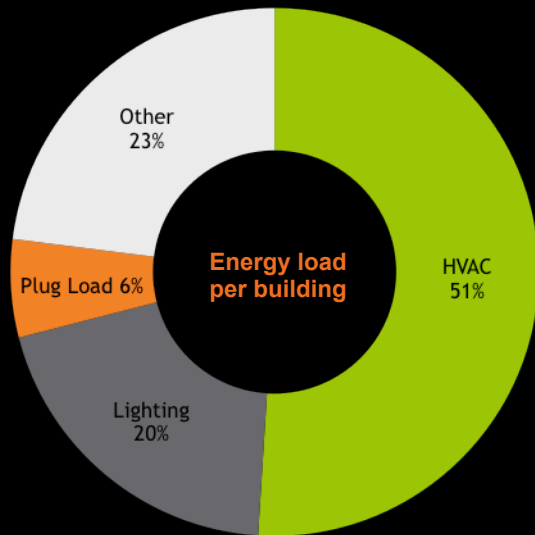


Buildings: 40% of US Energy Usage



Source: Berkeley Labs lbl.gov

We Start with the Largest Problem to Solve



Total annual average

Sources: IDC and the EIA Commercial Building Consumption Survey

HVAC system detail >

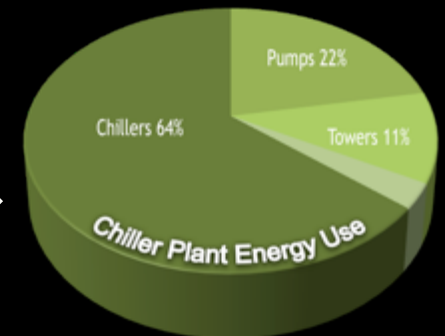
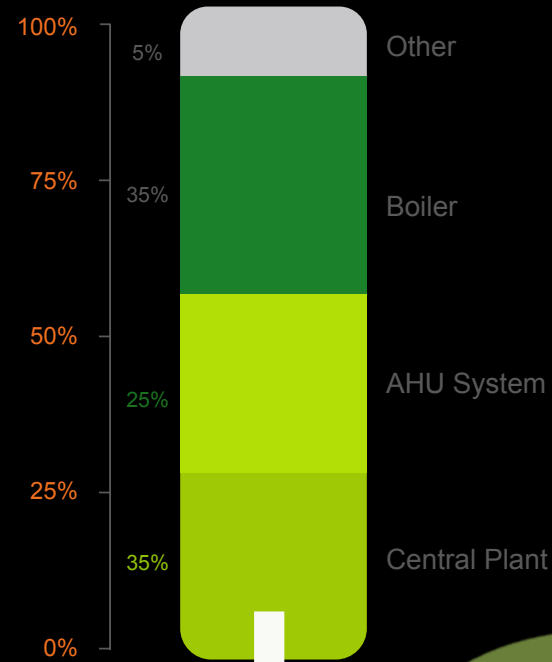
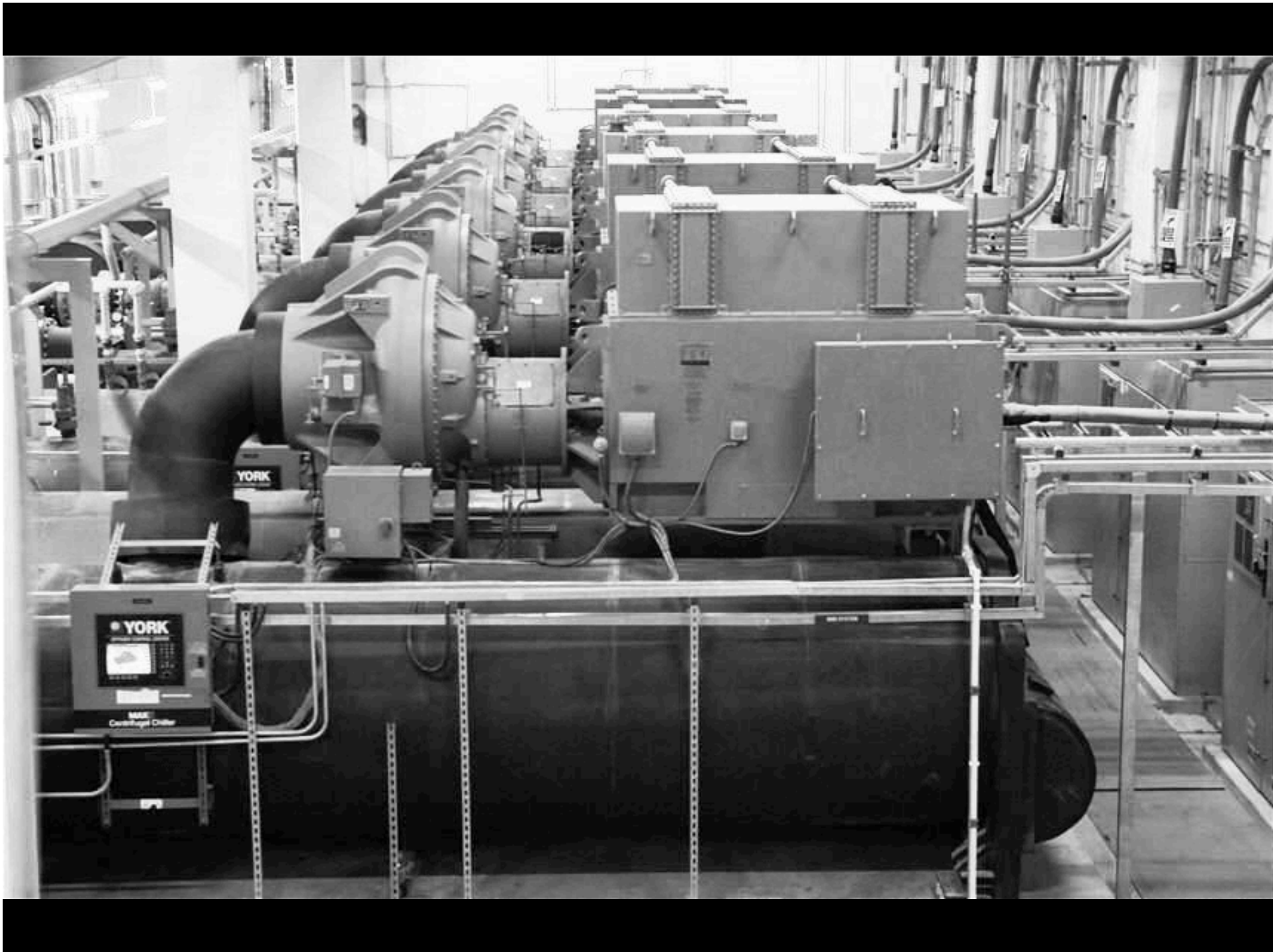






Image Landsat

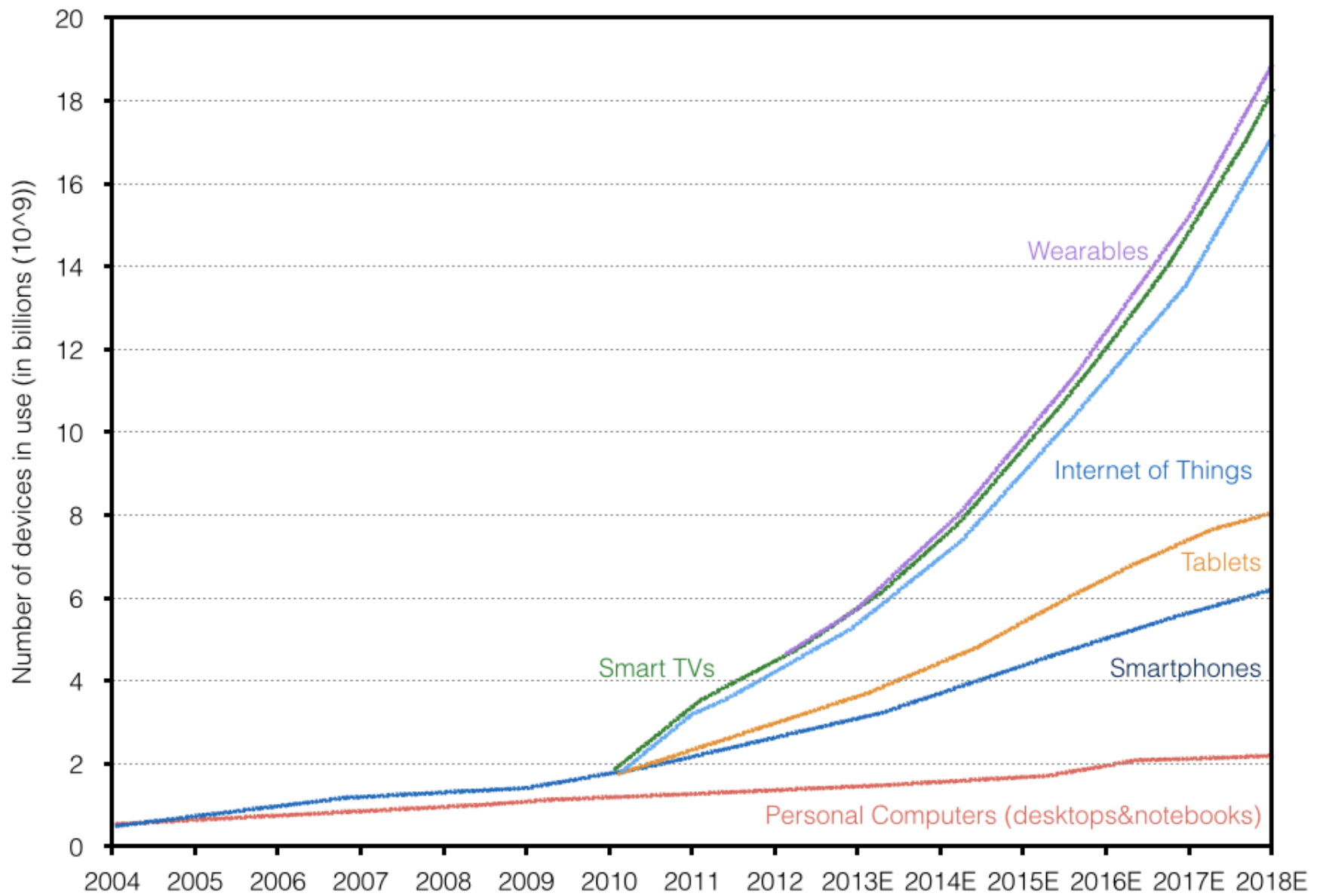
Data SIO, NOAA, U.S. Navy, NGA, GEBCO





Lesson #2:
The IIoT is not new.





Source: Gartner, IDC, Strategy Analytics, Machina Research, company filings, Business Insider Intelligence estimates

Io...Toast?



Credit: Chris Labrooy, Braun

IoC?

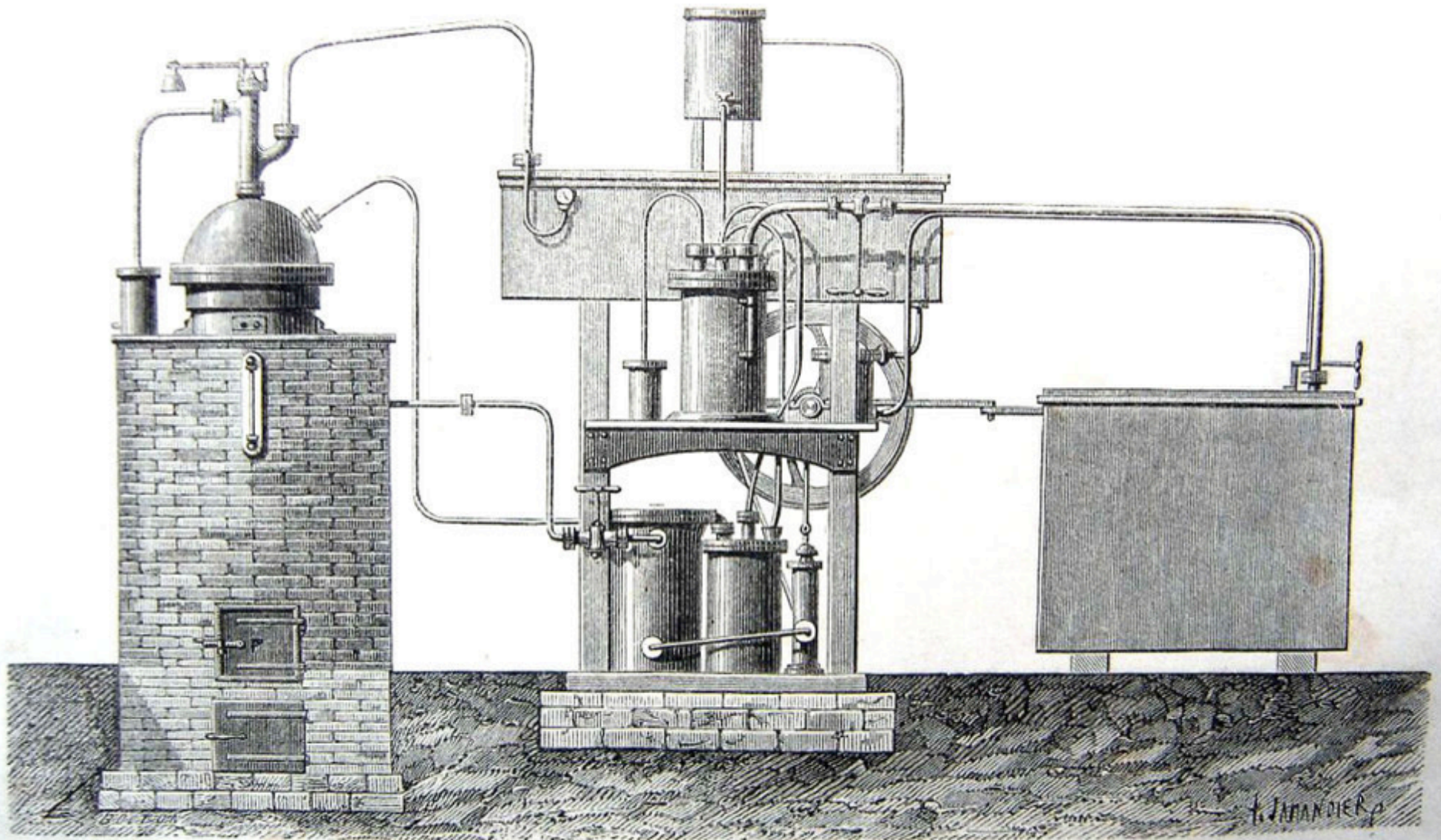


Credit: sociopatterns.org

IoS?



Credit: Erwin Blom



The first gas absorption refrigeration system , Ferdinand Carré ,1859



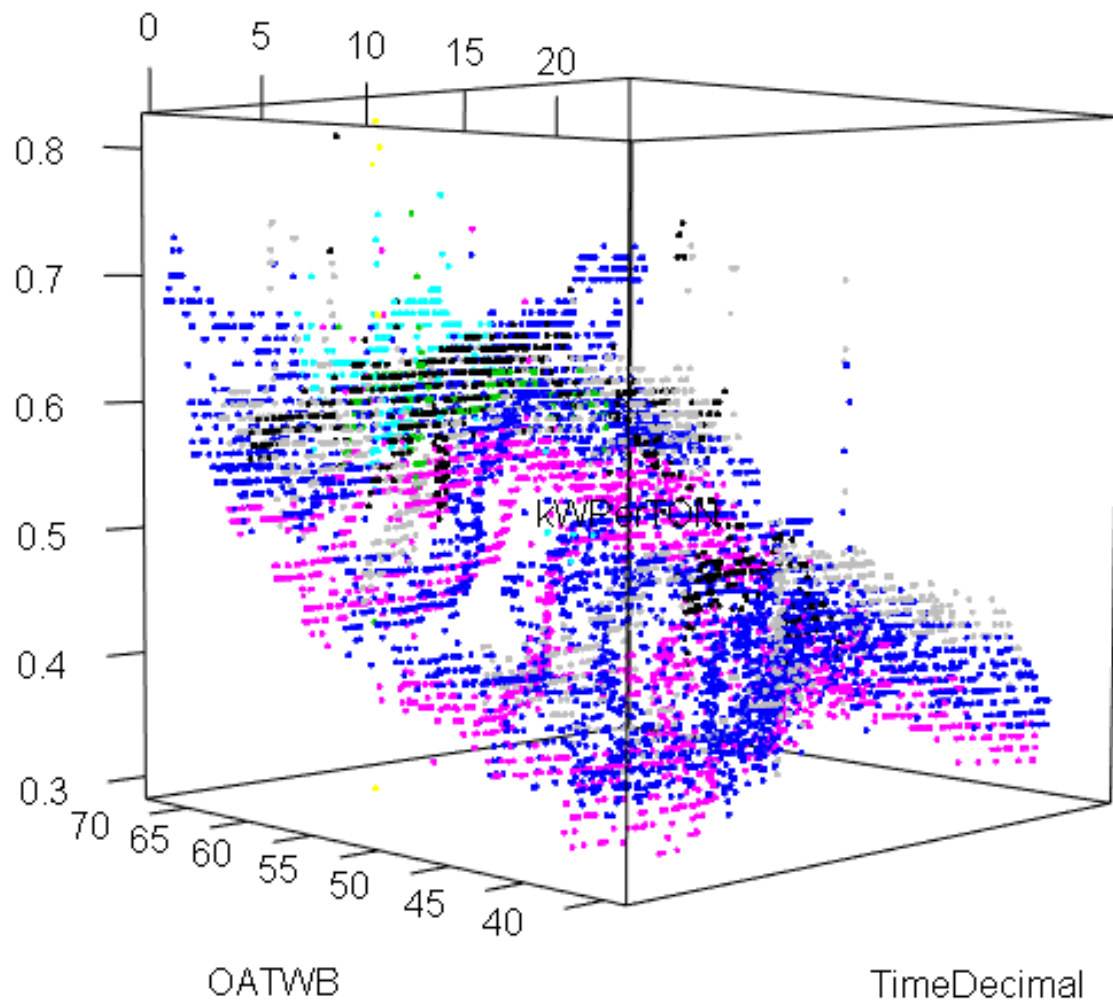
Lesson #3: Sometimes the obvious
solution is the best solution





WELL THERES YOUR
PROBLEM





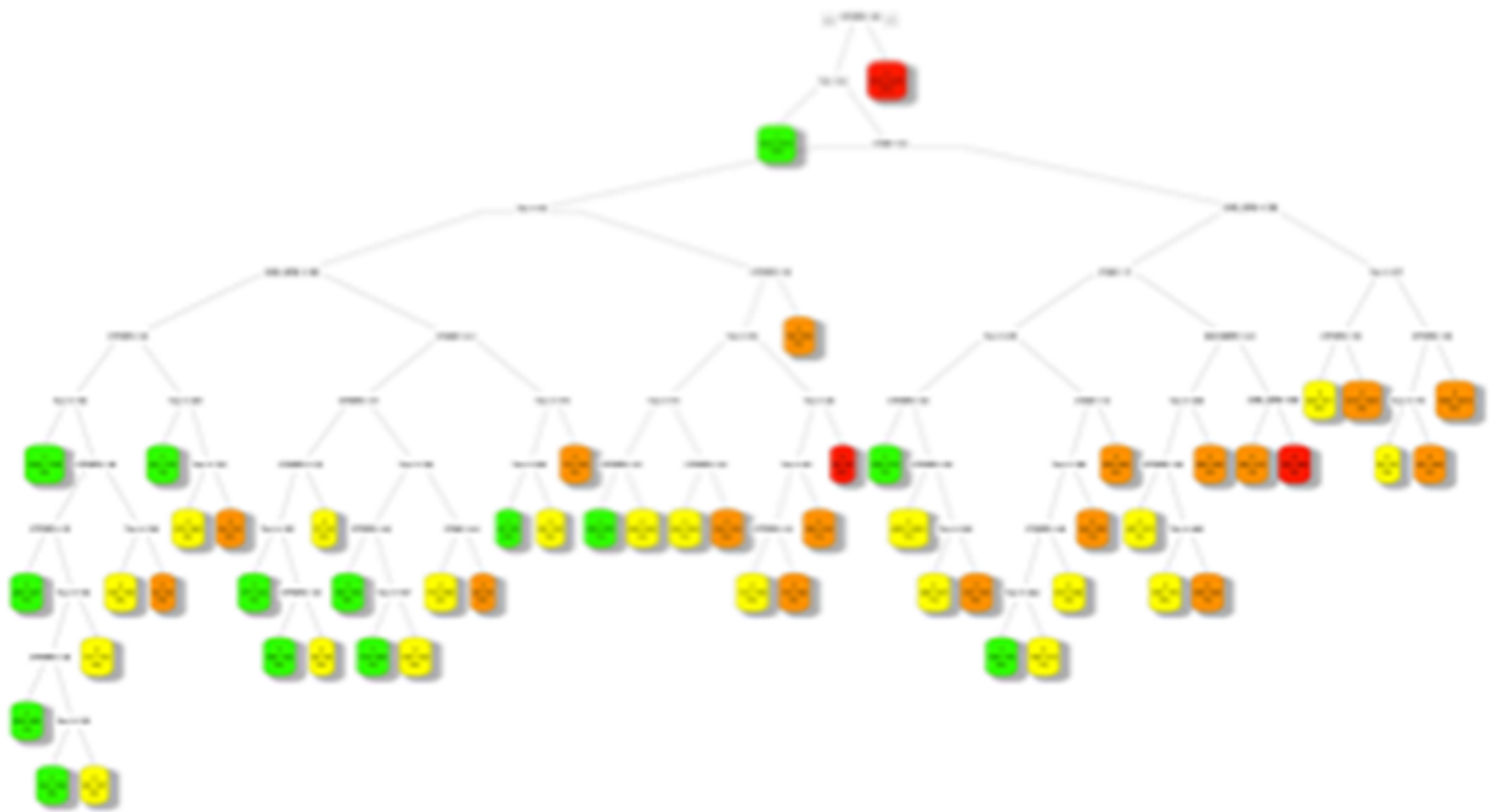
April Plant efficiency by Equipment Combo Active



Full Year Analysis

Note: Different Combos better in Winter vs. Summer months

MayThruOct						NovThruApril						WinterDiff	
ChillActive	0	1	2	3	4	5	0	1	2	3	4	5	
00000	0.78						0						-0.78
00011			0.665						0.404873				-0.26
00101									1.17				1.17
00110			0.635						0.384432				-0.25
00111				0.565449						0.460472			-0.10
01000	0.89												-0.89
01011				0.74									-0.74
01100		0.395097							0.431363				0.04
01101				0.623653									-0.62
01110				0.587012						0.444238			-0.14
01111					0.639095						0.607486		-0.03
10001		0.712143							0.446421				-0.27
10010									1.725				1.73
10011				0.63597						0.489135			-0.15
10101				0.7588									-0.76
10110				0.82									-0.82
10111					0.658957						0.529231		-0.13
11000		0.550168							0.456641				-0.09
11001				0.630232						0.504986			-0.13
11011					0.66679						0.539583		-0.13
11100				0.607944						0.497645			-0.11
11101					0.662014						0.613707		-0.05
11110					0.644116						0.569545		-0.07
11111						0.706132						0.6	-0.11



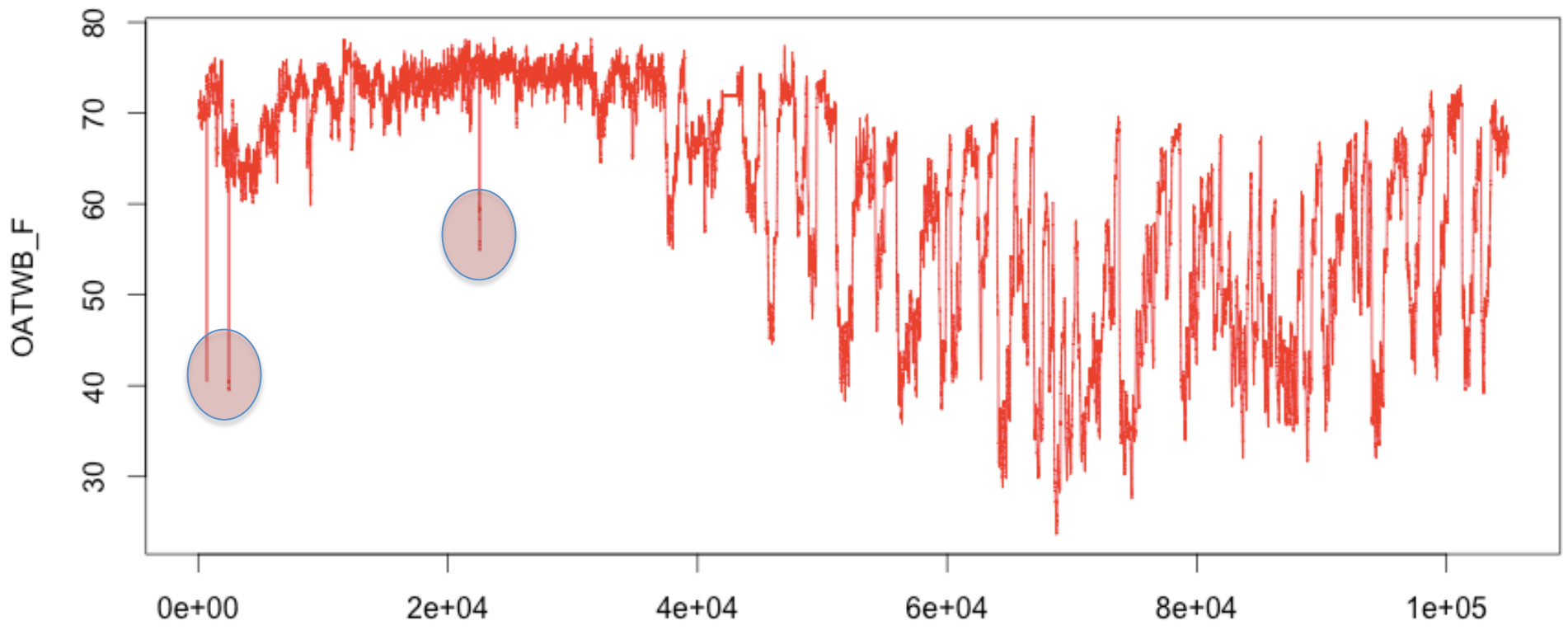
Lesson #4: IIoT isn't magic







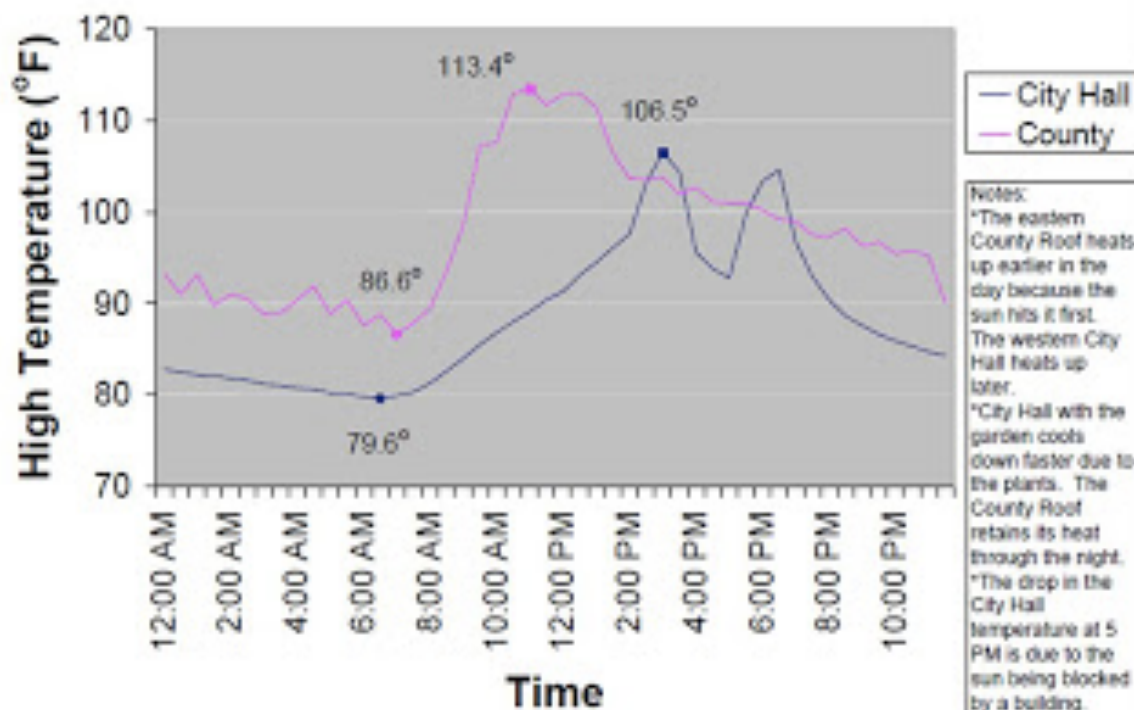
Lesson #5:
Outbound Recommendation Quality
 \leq Inbound Data Quality





http://gallery.surfacestations.org/main.php?g2_itemId=33747

08/08/01 Hourly Temperatures

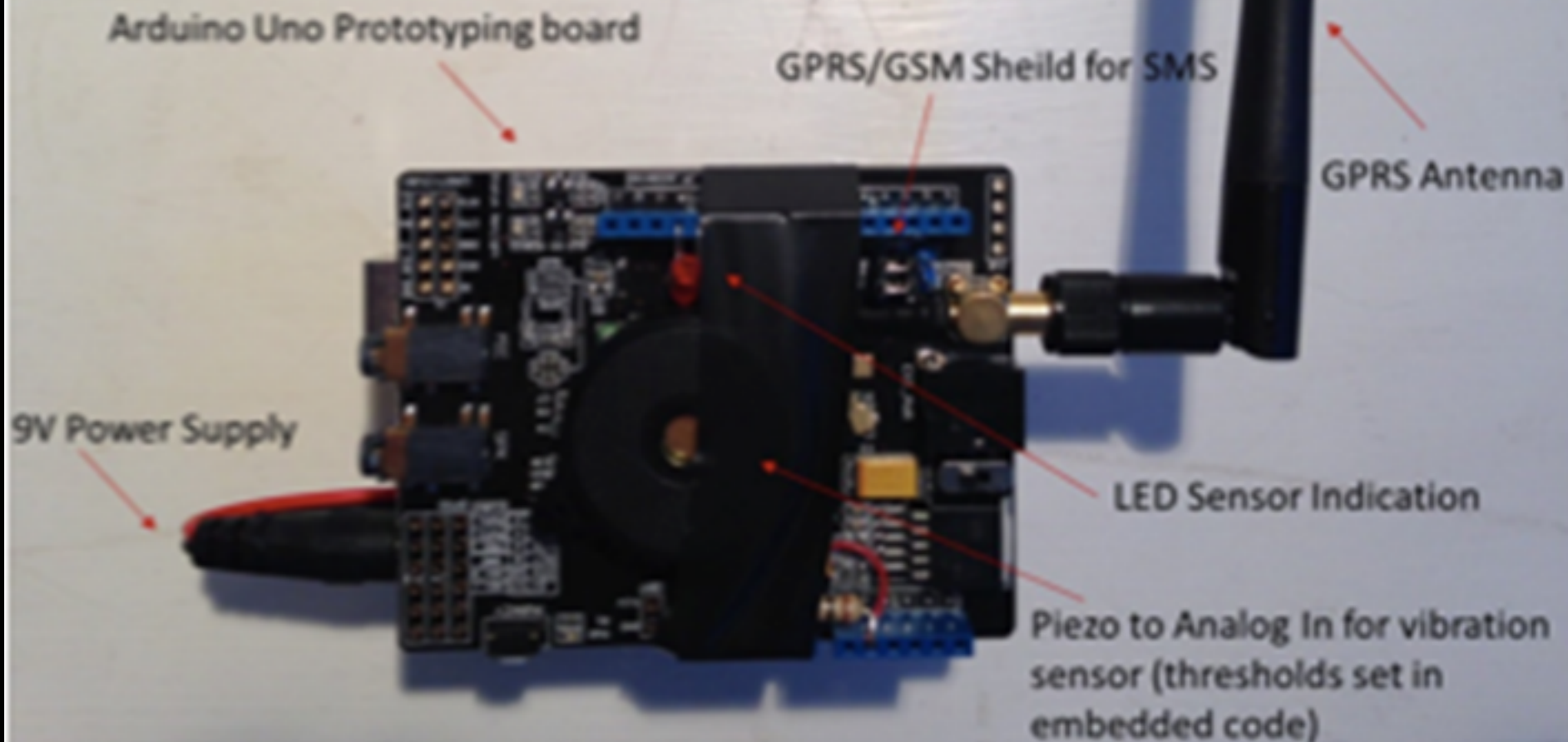


http://egov.cityofchicago.org/webportal/COCWebPortal/COC_ATTACH/temperature.pdf

Lesson #6: Sensors can improve accuracy in IIoT Signal



Vibration Sensor Prototype
The Data Guild for Optimum Energy
Fall 2013



PUNCH
THROUGH
DESIGN



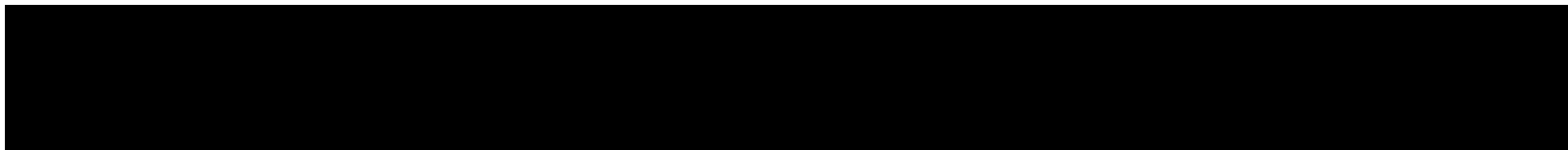
LightBlueTM
Bean

LightBlue™
Bean



DEMO: Sensor Prototypes w/LightBlue Bean





SurgeSensor \$

This example code is in the public domain.

```
*/
// these constants
const int ledPin =
const int knockSense
const int threshol

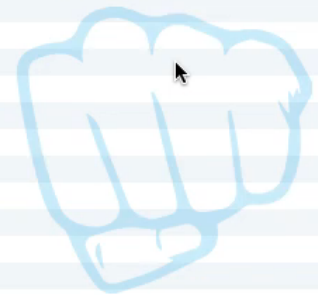
// these variables
int sensorReading =
int ledState = LOW

void setup() {
  pinMode(ledPin, OUTPUT);
  Serial.begin(9600);
  Serial.println("SurgeSensor v1.0");
}

void loop() {
  // read the sensor value
  sensorReading = analogRead(knockSense);
  Serial.print("Temp: ");
  Serial.print(sensorReading);
  Serial.print("\t");
  Serial.print("RSSI: ");
  Serial.print(rssi);
  Serial.println();

  // if the sensor reading is greater than the threshold:
  if (sensorReading >= threshold) {
    // toggle the status of the ledPin:
    ledState = !ledState;
    // update the LED pin itself:
    digitalWrite(ledPin, ledState);
    // send the string "Knock!" back to the computer, followed by newline
    Serial.println("Surge Detected on Chiller #6!");
  }
}
//end now a cool light show
```

RSSI	Name	Status	Sketch
-46	Bean	Disconnected	



/tmp/tty.LightBlue-Bean

Send

Autoscroll No line ending 9600 baud

Done compiling.

/Applications/Arduino.app/Contents/Resources/Java/hardware/tools/avr/bin/avr-objcopy -O ihex -R .eeprom /var/folders/ff/vg622qvj7m958pqh61mvv_2r0000gp/T/build5502425776412165209.tmp/SurgeSensor.cpp.elf /var/folders/ff/vg622qvj7m958pqh61mvv_2r0000gp/T/build5502425776412165209.tmp/SurgeSensor.cpp.hex
Binary sketch size: 6,540 bytes (of a 32,256 byte maximum)



DEMO: Sensor Prototypes w/LightBlue Bean



Lesson #7: People contribute
more to success than technology



Region	Only or Mostly Human Data	Equally Human and Machine Data	Only or Mostly Machine Data
US/Canada (51%)	66%	19%	11%
Europe (27%)	49%	30%	21%
Asia (11%)	52%	24%	24%
Latin America (8.2%)	94%	0%	6%
ALL	62%	21%	15%

Credit: KDNuggets





Kari Hensien

Matt Frey

Clark Matthys

Peng Chen

Hal Wilkinson

Chris Boscolo

Lynn Johnson

Ian Dempster

Ben Erpelding

Jonathan Shaw

Thomas Jones

Kathy Briggs



Dan Post

Cameron Turner

Chris Diehl

Sandy Nader

Dennis L.

David Gutelius

Lesson #8: Deployment is hard

*You need people who know what
they're doing.*

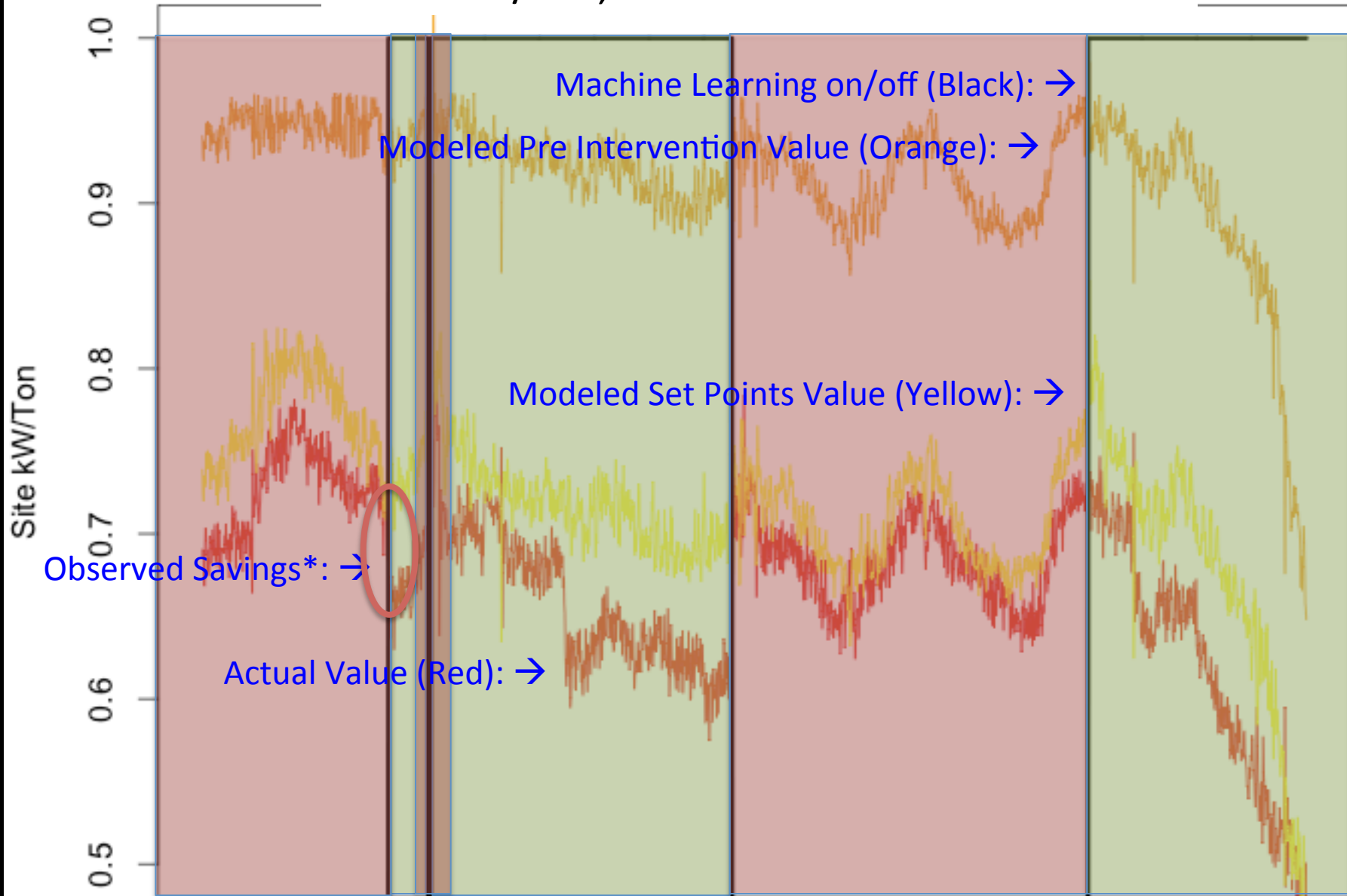


Powered by
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FRAMEWORK®

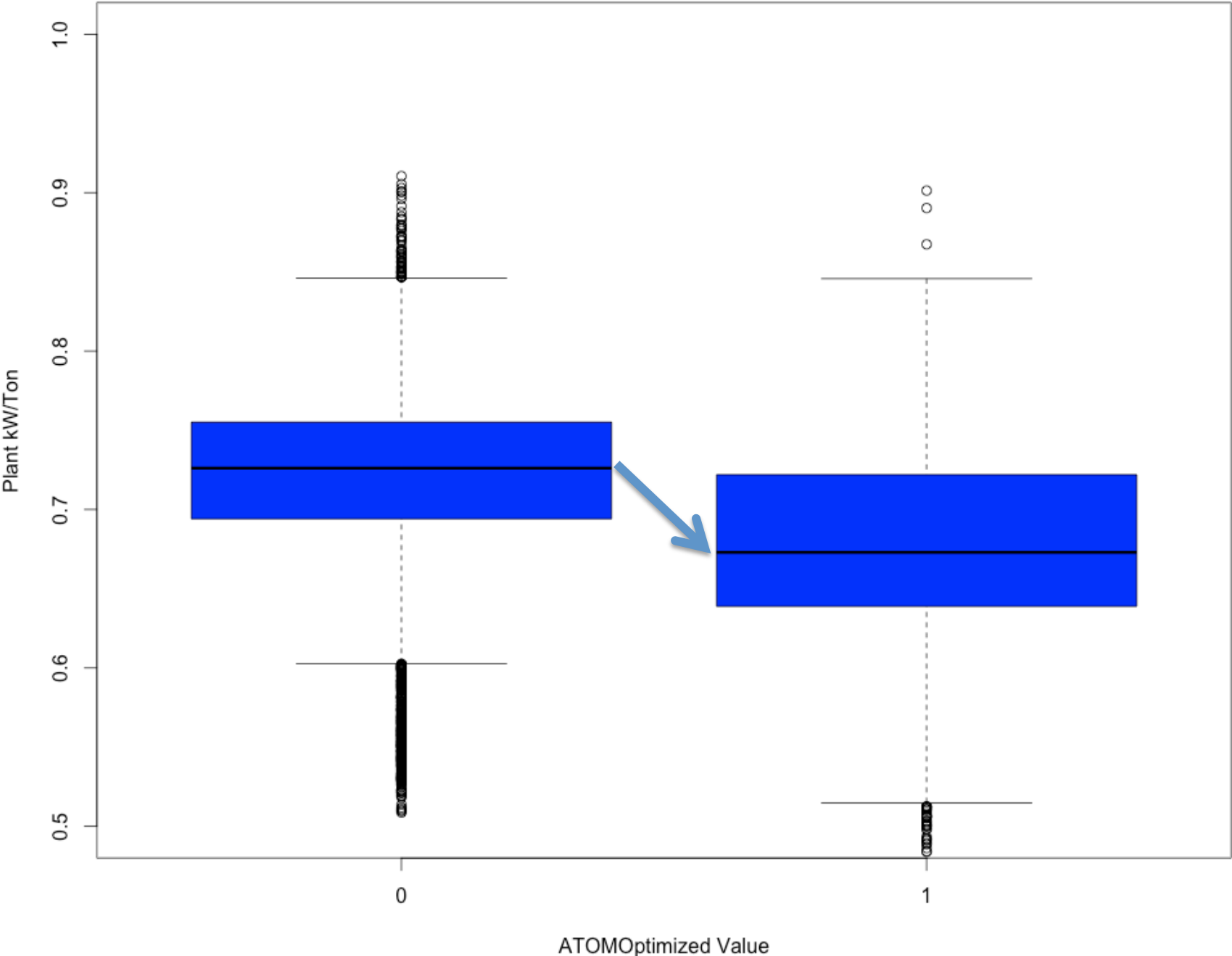
Lesson#9: Persist to Prevail



Plant kW/ton, 2014-09-28 to 2014-10-04



Vistakon: Plant Efficiency by ATOM State



Lesson #10: Do what you love,
the rest will follow



**DO
WHAT
YOU
LOVE**

**LOVE
WHAT
YOU
DO**

Thank you!



THE
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@dataguild

www.thedataguild.com

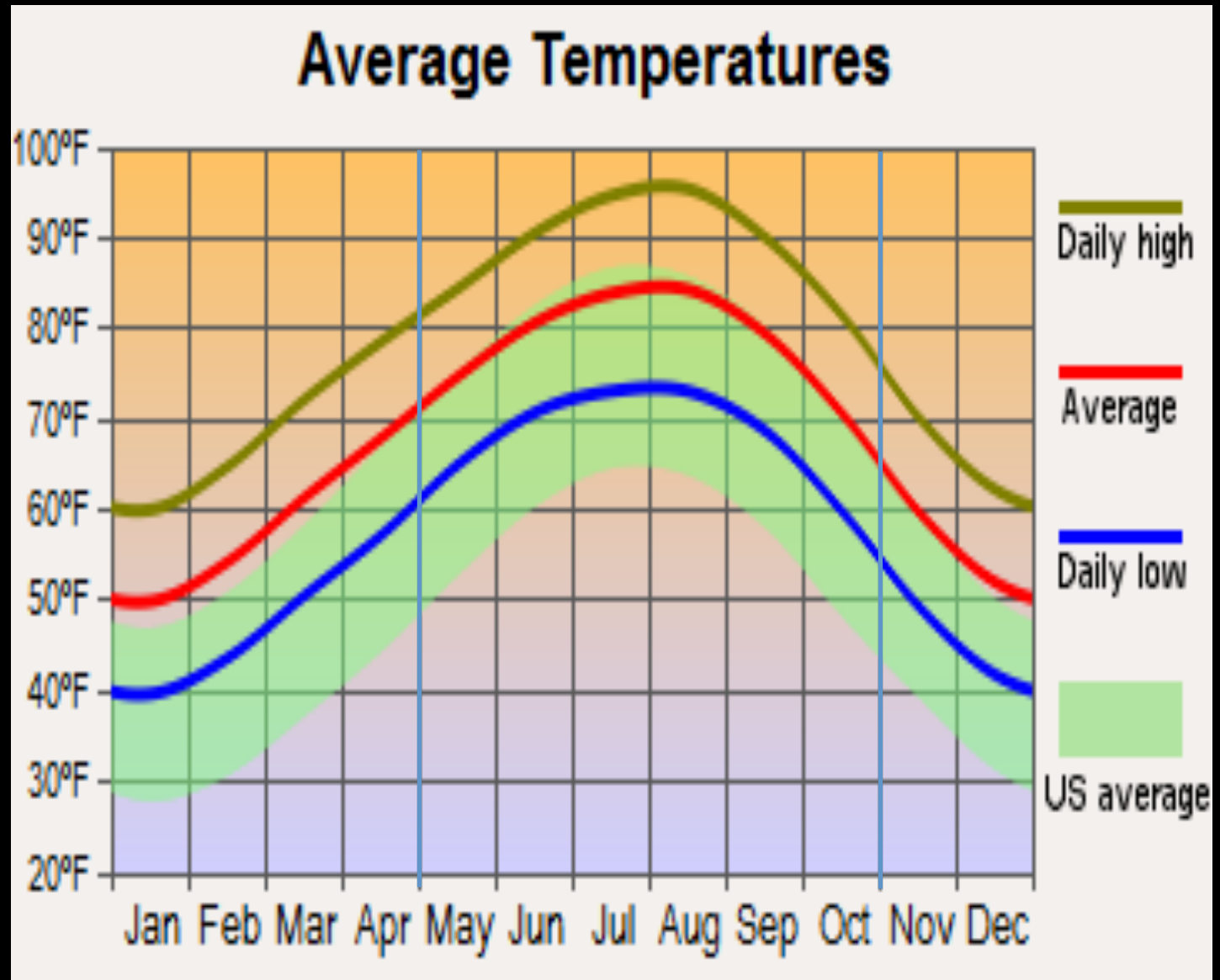
@trueoptimize

www.optimumenergyco.com

<https://vimeo.com/108490134>

Appendix

Austin, TX Average Temps



<http://www.city-data.com/city/Austin-Texas.html>