

Automation Controls and Energy & Maintenance Savings at UNL

Lalit Agarwal

Director, Utility and Energy Management

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Building Automation

System
Development

Construction

Operation

Controller
Manufacturing

Controller and
Software
Development

Design

Install

Maintain

Monitor

Operate

UNL BAS History

- Early era - Johnson Controls T6000
- 1978 - Visit to UCSD (Cal San Diego)
- 1979 - EMS I
- 1980 - First Hardware
- 1996 - First Microprocessor Thermostat
- 2000 - Y2K Compliant System
- 2006 - Linux/Java/TCPIP

Today 220+ Buildings, 650,000+ I/O objects

The What?

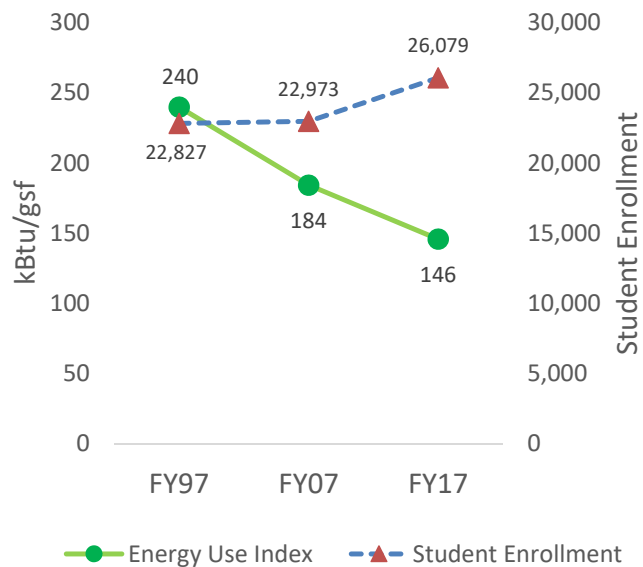
- Mechanical System Controls
- Room Temperature Controls
- Fume Hood Controls
- Laboratory Pressurization Controls
- Greenhouse Temperature Controls
- Building Utility Metering
- Lighting Controls

The Why?

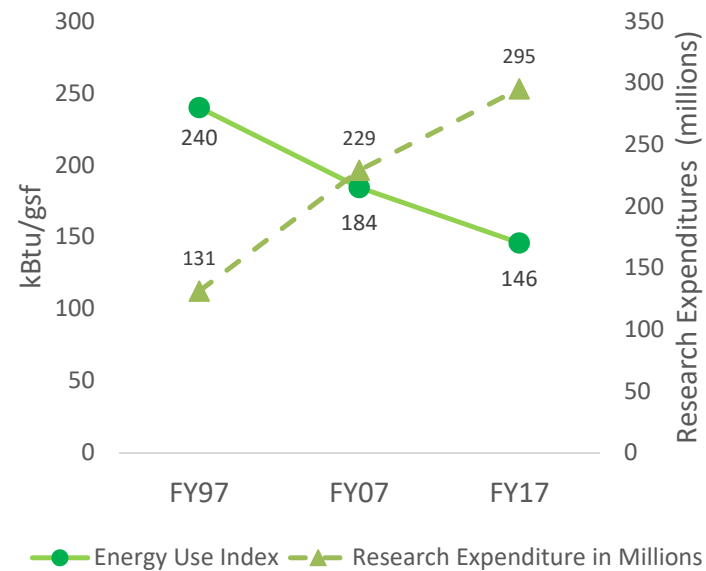
- Non Proprietary
- Standardization
 - One System
 - One User Interface
 - One Set of Spare Parts etc.
- Proven Success and Innovation
- Flexibility
- Save Energy

20-year Energy Use Index (EUI) UNL State Buildings

EUI and Enrollment

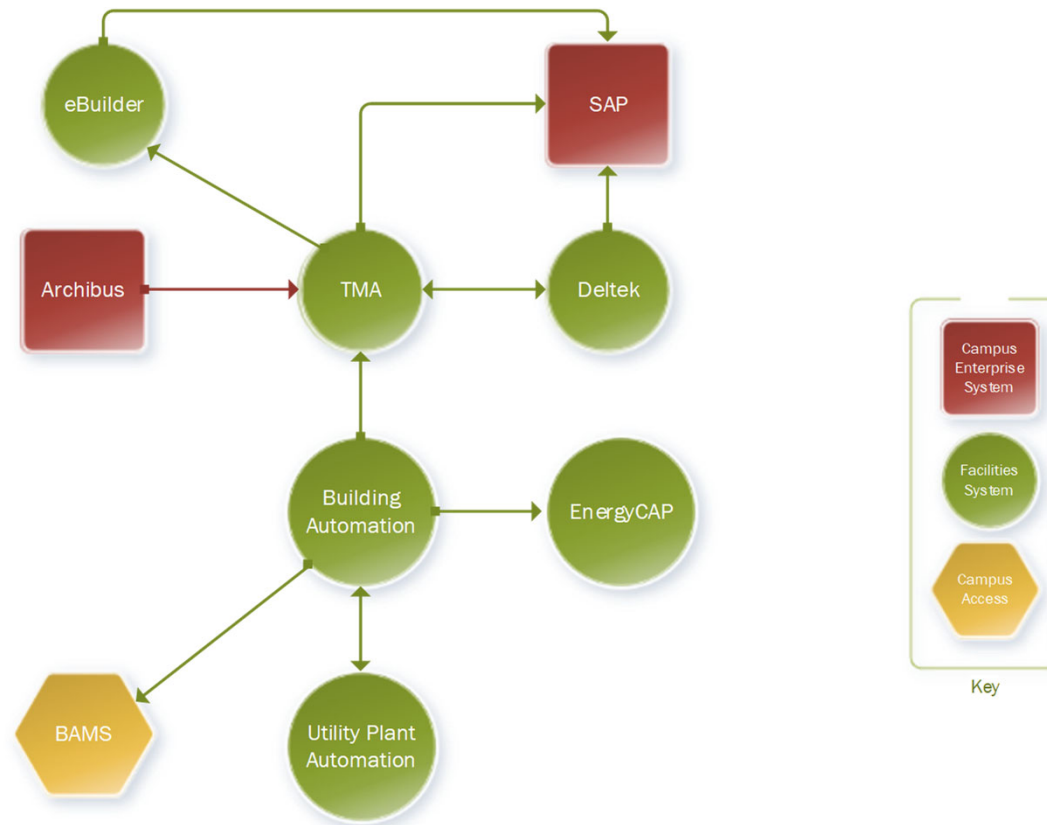


EUI and Research



Integrated Systems

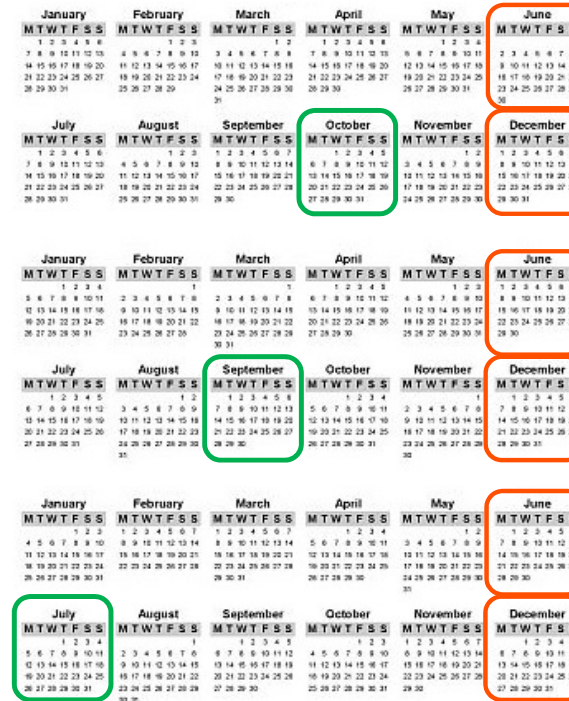
System Integrations



IoT in Action

Through Integration

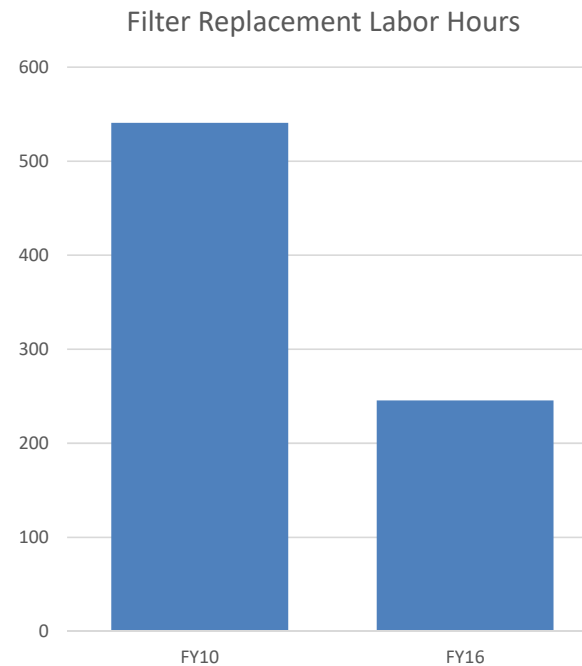
- Semi-annual Fan, Pump, and Motor PMs
- Average frequency reduced from 6 to 10.5 months
- 30% operational savings versus calendar-based PMs



IoT in Action

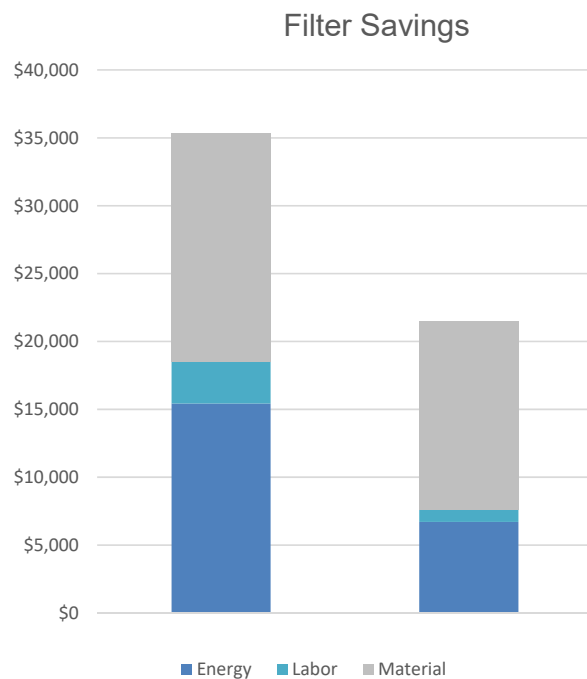
Through Integration

- 55% reduction in labor hours
- 50% fewer filters
- Reduced energy consumption
- Reduced environmental impact
- Improved Indoor Air Quality



IoT in Action - Example

Chemistry Building



Continuous Commissioning

Recommissioning - Example

International Quilt Museum

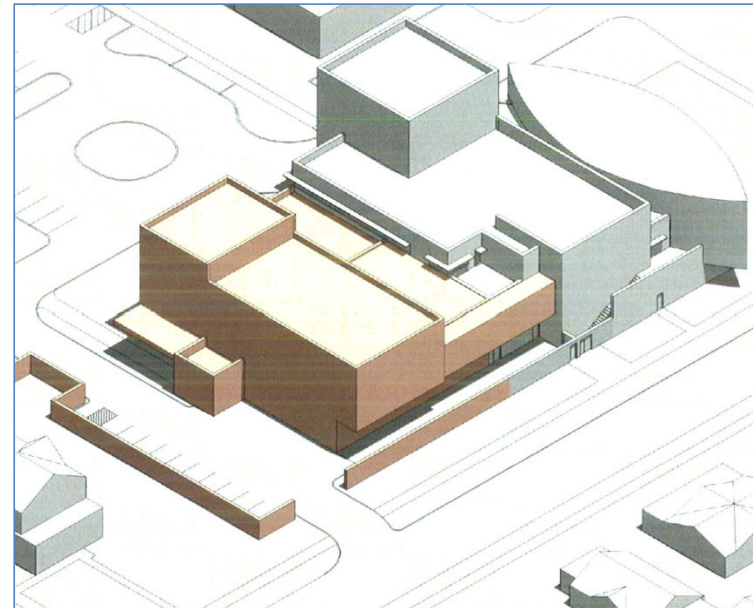
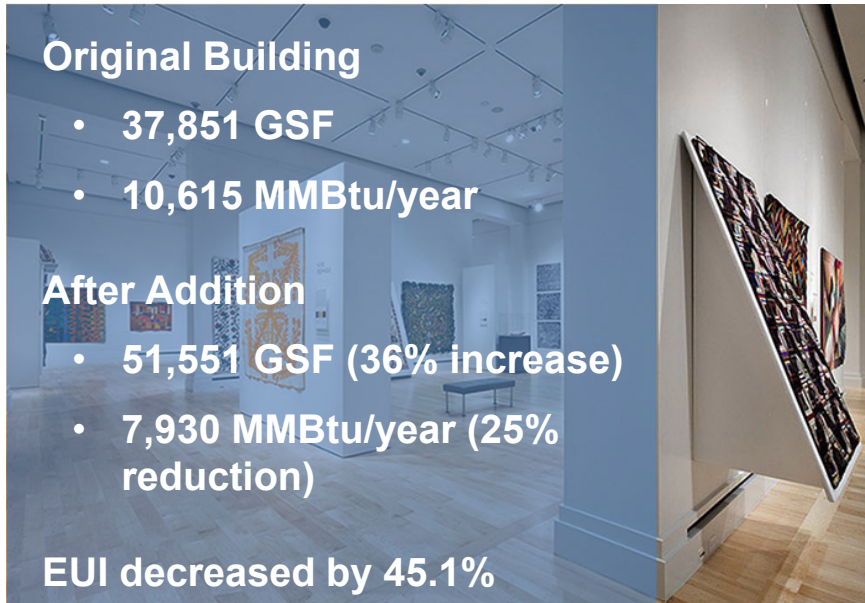
Original Building

- 37,851 GSF
- 10,615 MMBtu/year

After Addition

- 51,551 GSF (36% increase)
- 7,930 MMBtu/year (25% reduction)

EUI decreased by 45.1%



Recommissioning Savings

Cumulative Energy Savings

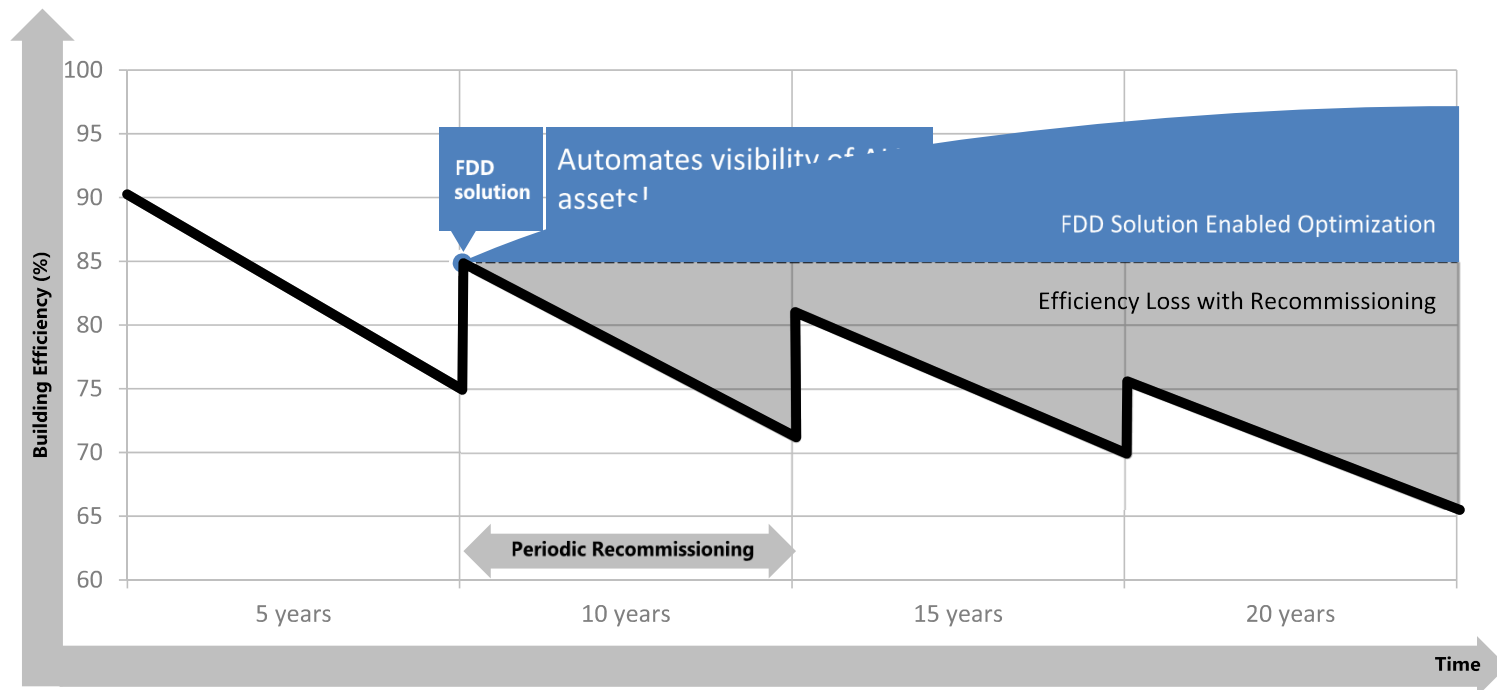
University of Nebraska-Lincoln Recommissioned Buildings	Baseline Cost	Actual Cost	Avoided Cost	Avoided Cost %	Months Elapsed	Avoided To-Date
ALEX - Alexander Building	\$5,747	\$5,373	\$374	6.5%	4	\$374
ANDN - Andersen Hall	\$26,470	\$26,957	(\$487)	-1.8%	22	(\$892)
ANSC - Animal Science Complex	\$312,359	\$306,899	\$5,460	1.7%	15	\$6,825
AVH - Avery Hall	\$83,390	\$87,742	(\$4,351)	-5.2%	28	(\$10,153)
ENTO - Entomology Hall	\$35,944	\$35,589	\$355	1.0%	13	\$384
FMS - Facilities Management Shops	\$59,802	\$57,945	\$1,857	3.1%	30	\$4,643
HARH - Hardin Hall	\$84,461	\$80,338	\$4,123	4.9%	21	\$7,215
KCR - Kiesselbach Crops Research Lab	\$16,390	\$12,771	\$3,619	22.1%	13	\$3,920
KEIM - Keim Hall	\$71,877	\$76,143	(\$4,266)	-5.9%	26	(\$9,243)
MOLR - Morrison Center	\$83,706	\$77,917	\$5,789	6.9%	9	\$5,789
OTHM - Othmer Hall	\$135,133	\$128,950	\$6,182	4.6%	6	\$6,182
QH - Quilt House	\$325,220	\$185,747	\$139,473	42.9%	40	\$464,910
RVB - Mary Riepma Ross Media Arts	\$144,818	\$112,711	\$32,107	22.2%	33	\$88,294
SHEL - Sheldon Museum of Art	\$49,575	\$35,153	\$14,423	29.1%	23	\$27,643
TEAC - Teachers College Hall	\$9,881	\$9,881	\$0	0.0%	4	\$0
Totals	\$1,444,774	\$1,240,117	\$204,657	14.2%		\$595,891



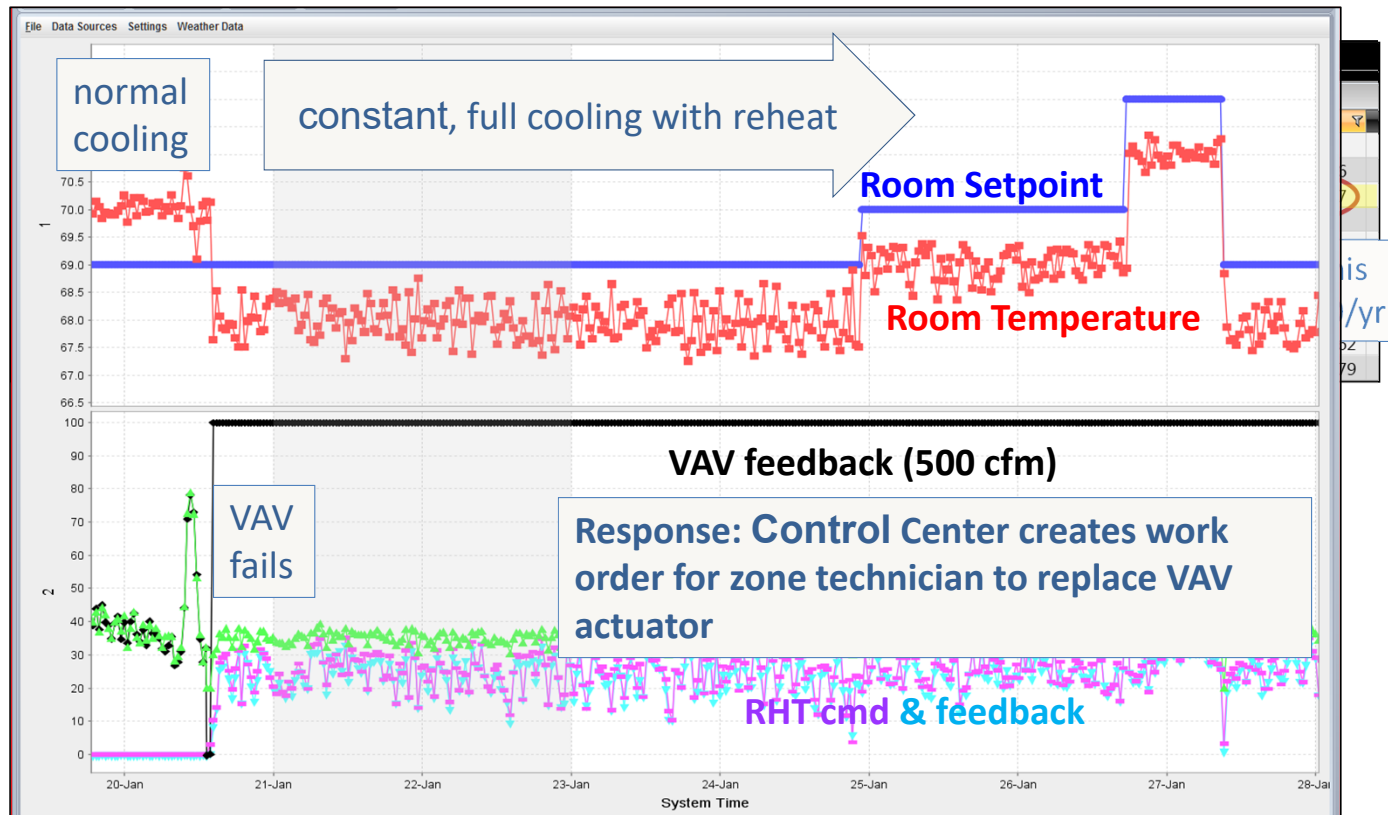
14% reduction in annual energy costs (average)



Continuous Commissioning with FDD



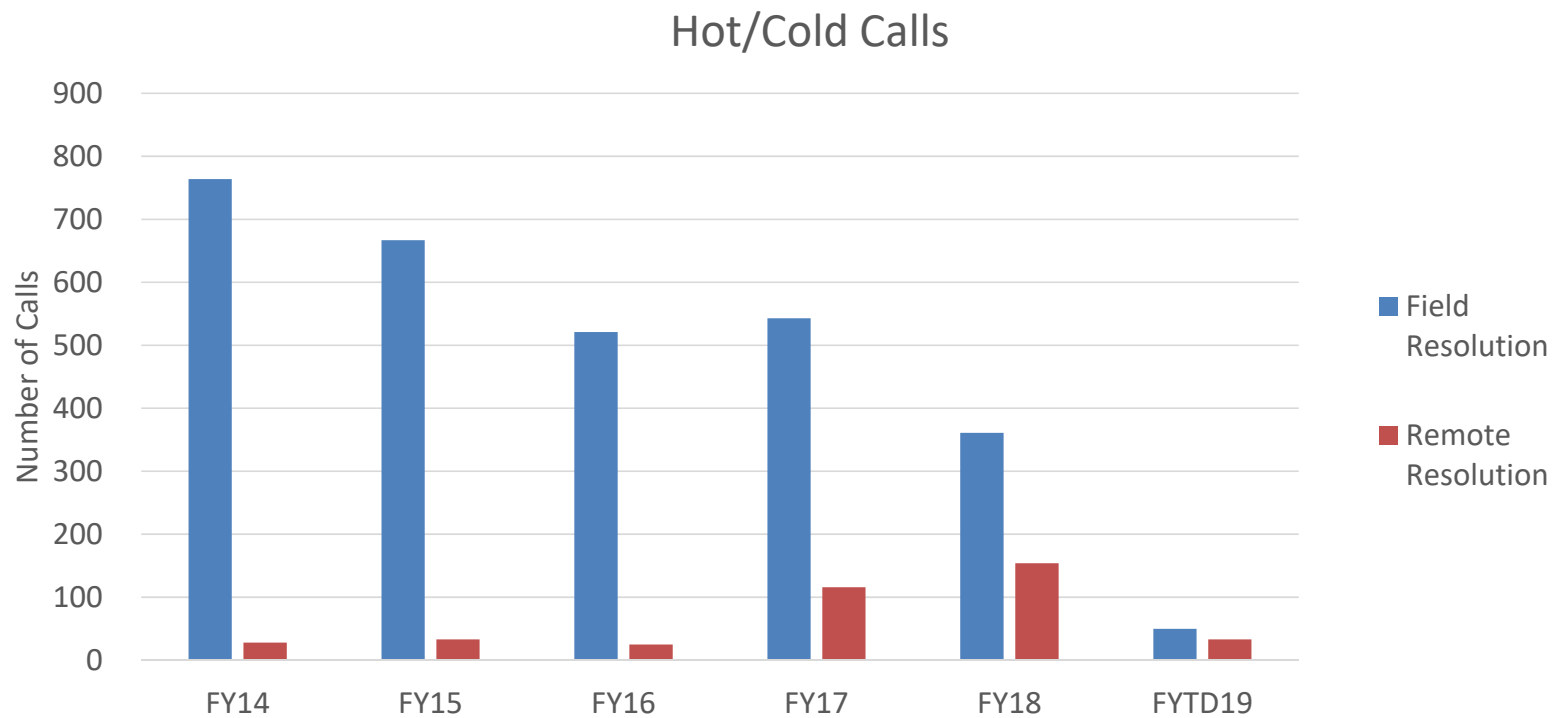
Example Fault



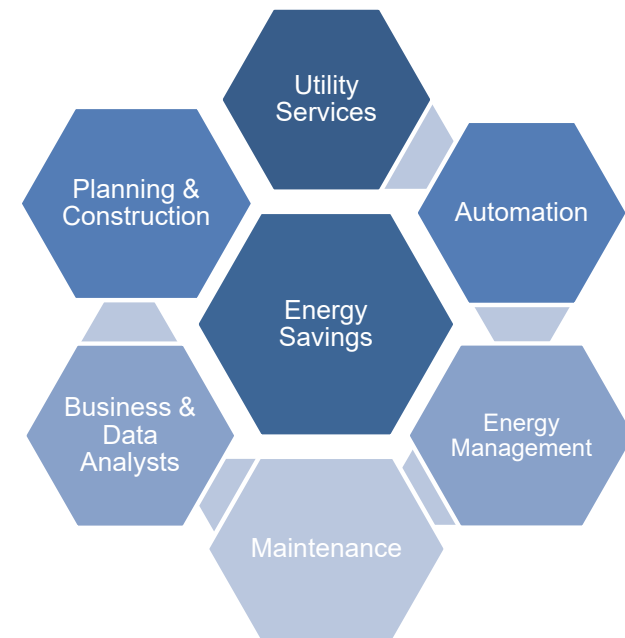
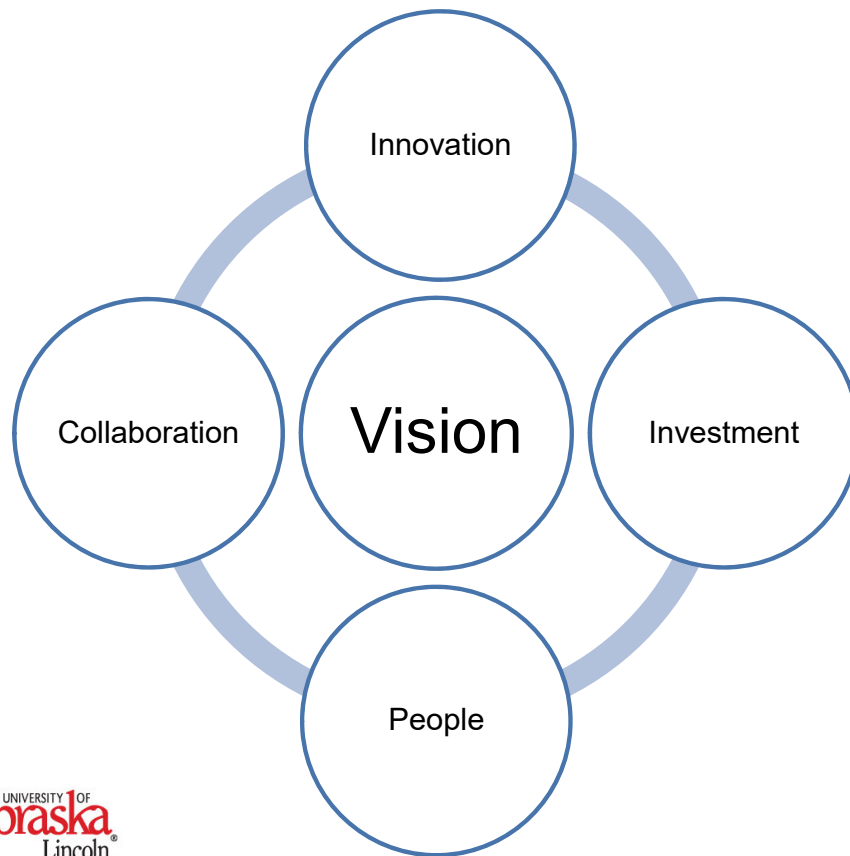
FDD Identified Cost Avoidance

	2016	2017	2018
Cost if Uncaught	\$5,274	\$30,188	\$146,066
Fault Actual Cost	\$209	\$936	\$7,952

Reducing Technician Labor



What makes our program possible?



Questions?

