

EXPERIENCES BUILDING A EUROPEAN STYLE HOT WATER CAMPUS DISTRICT ENERGY SYSTEM IN NORTH AMERICA

AGENDA

- 1. Energy Planning** – Achieving stakeholder buy
- 2. European Design** – Advantages & highlights
- 3. Procurement** – Right sourcing
- 4. Construction** – Lessons learned
- 5. Next steps** – Connecting buildings
- 6. Questions?**

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ABOUT SHERIDAN



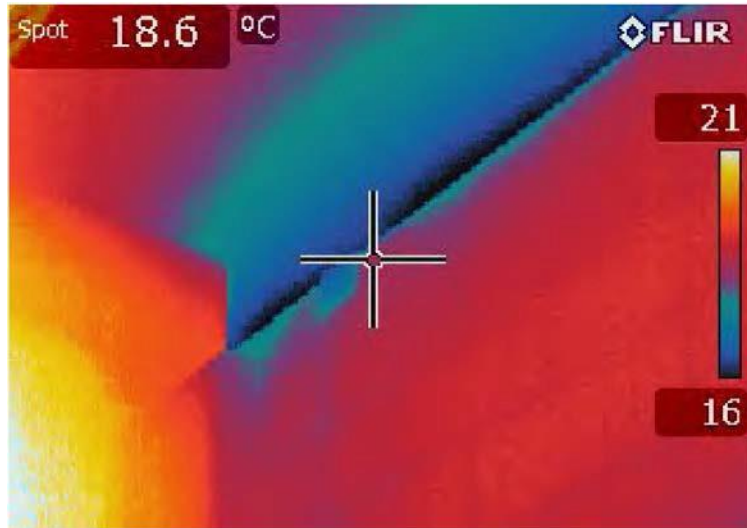
Hazel McCallion Campus
Mississauga, Ontario



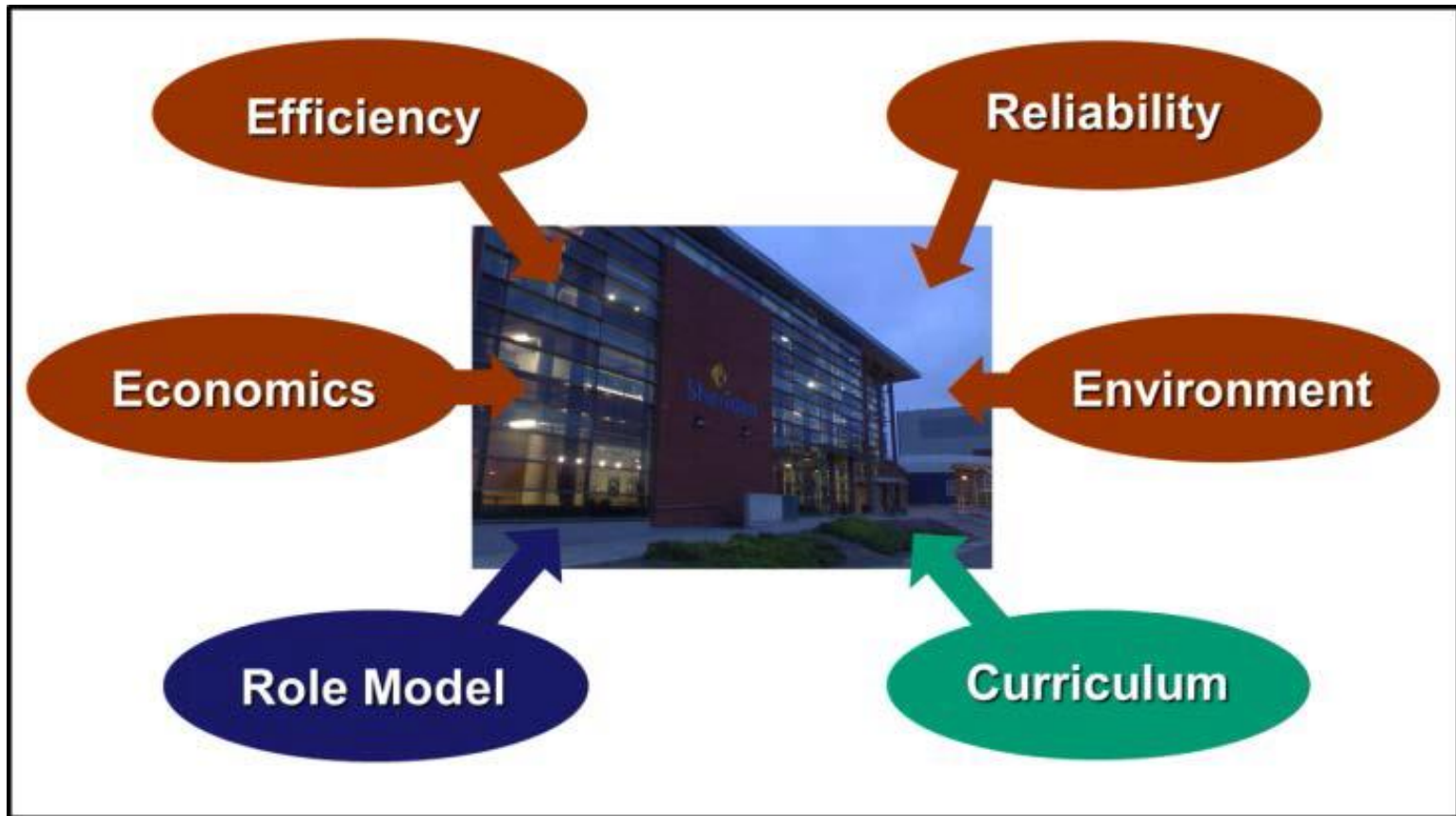
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INSTITUTIONAL PAIN POINTS



BROADER GOALS



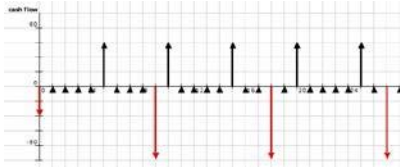
SETTING GOALS

Standard Energy Plan	Breakthrough Energy Plan
Built on Expected Performance	Drives Exceptional Performance
Uses a Forecasting Approach	Uses a Backcasting Approach
Builds Technical Case, Then Financial	Builds Both Cases Simultaneously
Predetermines an Approach	Suggests Approaches, Then Tests
Uses Simple Financial Models	Uses Integrated Financial Models
Energy Savings < 20%	Energy Savings > 50%
	Inspires Organization
	Establishes Leadership Position

MAINTAIN PLANNING OWNERSHIP

- Supports Organizational Learning and Growth
- Leverages Competencies Within Organization
- Leverages Competencies Around Organization
- Aligns Team Around Implementation

SET FRAMING GOALS



7% Internal Rate of Return



40% Reduction in
Carbon Emissions



50% Reduction in Source
Energy Consumption

CONSTRUCT SCENARIOS

Base Case

Scenario 1: Gain Control & Metering

Scenario 2: 1 + Building Efficiency Investments

Scenario 3: 2 + Integrated Energy Distribution

Traf: Steam to H/W

Davis: Connect.Buildings

Scenario 4: 3 + Energy Distribution & Supply

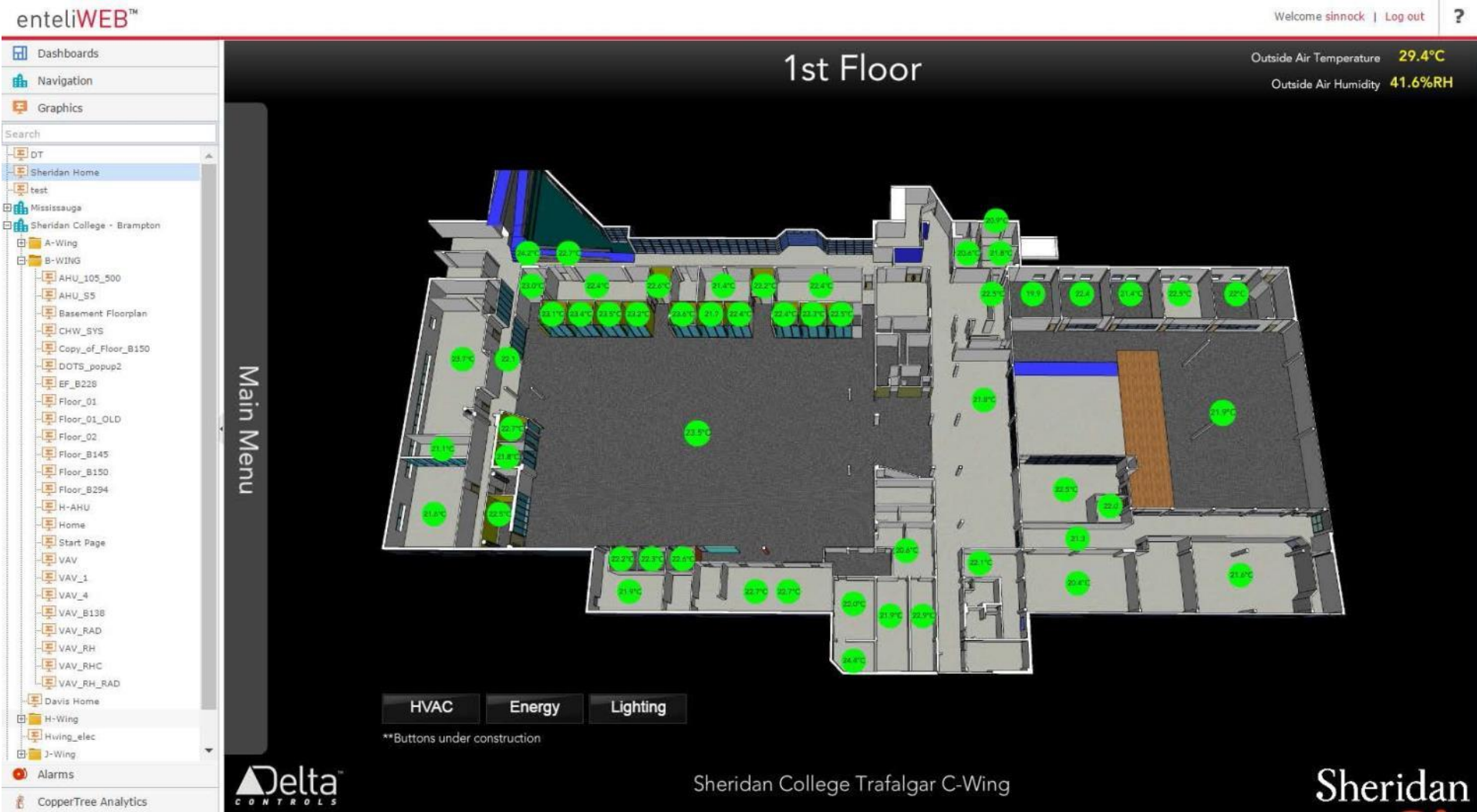
Traf: Boilers /
Absorption / CHP

DV: Boilers / CHP

SHERIDAN'S RESULTS

Condition		Energy (MWh/year)					Emissions	Savings (%)		
#	Scenario	Gas	Electricity Purchase	Electricity conversion	Total on site	Total Source *)	CO ₂ (mt)	Energy on site	Energy Source	CO ₂
<i>Including PV Constant CO₂-Index Electricity</i>										
	Baseline 2010	19,900	28,300	57,500	48,200	105,700	9,660	0%	0%	0%
2035 Results										
0	Scenario 0: Base Case	23,300	31,100	63,100	54,400	117,500	10,900	-	-	-
1	Scenario 1: Gain Control	16,100	19,200	39,000	35,300	74,300	7,080	35%	37%	35%
2	Scenario 2: Gain Control and Building Efficiency	12,100	13,000	26,400	25,100	51,500	5,030	54%	56%	54%
3	Scenario 3: Integrated Energy Distribution	12,100	13,000	26,400	25,100	51,500	5,030	54%	56%	54%
4	Scenario 4: Integrated Energy Supply	24,400	4,600	9,300	29,000	38,300	5,820	47%	67%	47%
*) Source energy: Energy used on site plus energy losses in electricity generation and distribution										

Building Automation Operator Display



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Hundreds of Pounds of Copper Cabling Removed



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G Wing: Thermal and Flow Meters Interfaced to BAS



Performance

No Comparison

Baseline Comparison

Target Comparison

Breakdown

Utilities:



Water Volume



4,589 m³

Thermal Energy



15,774 kWh

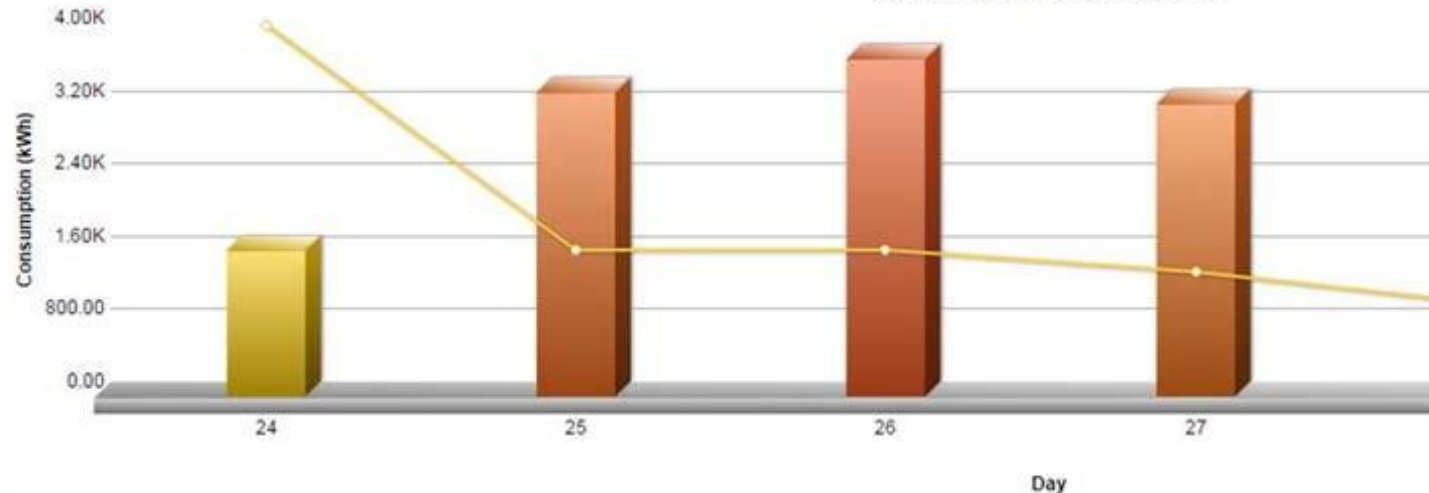
« 2015-01-29 »

Sun	Mon	Tue
4	5	6
11	12	13
18	19	20
25	26	27

1 Low Usage
1,490.88 kWh or lower

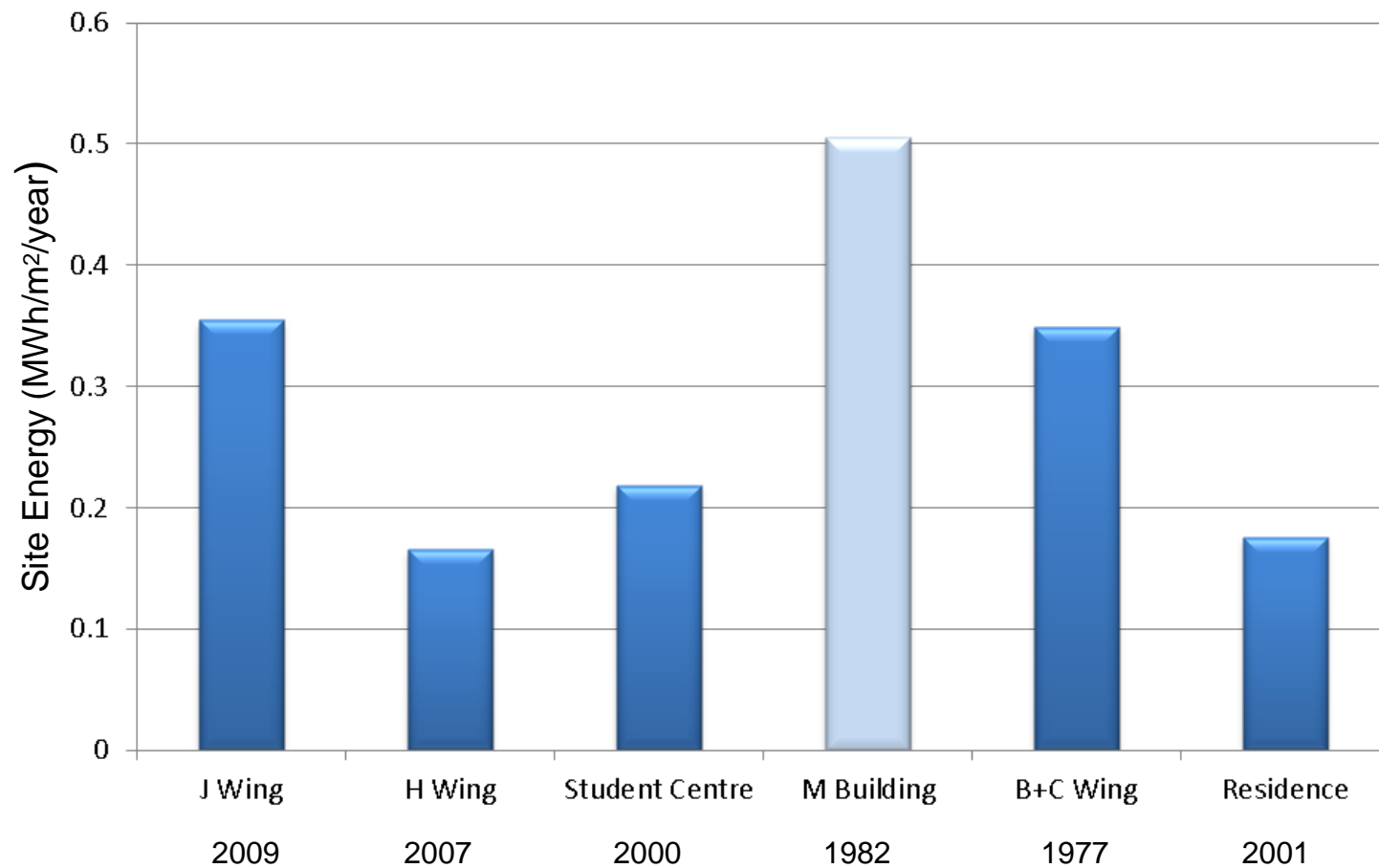
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Consumption for January 2015

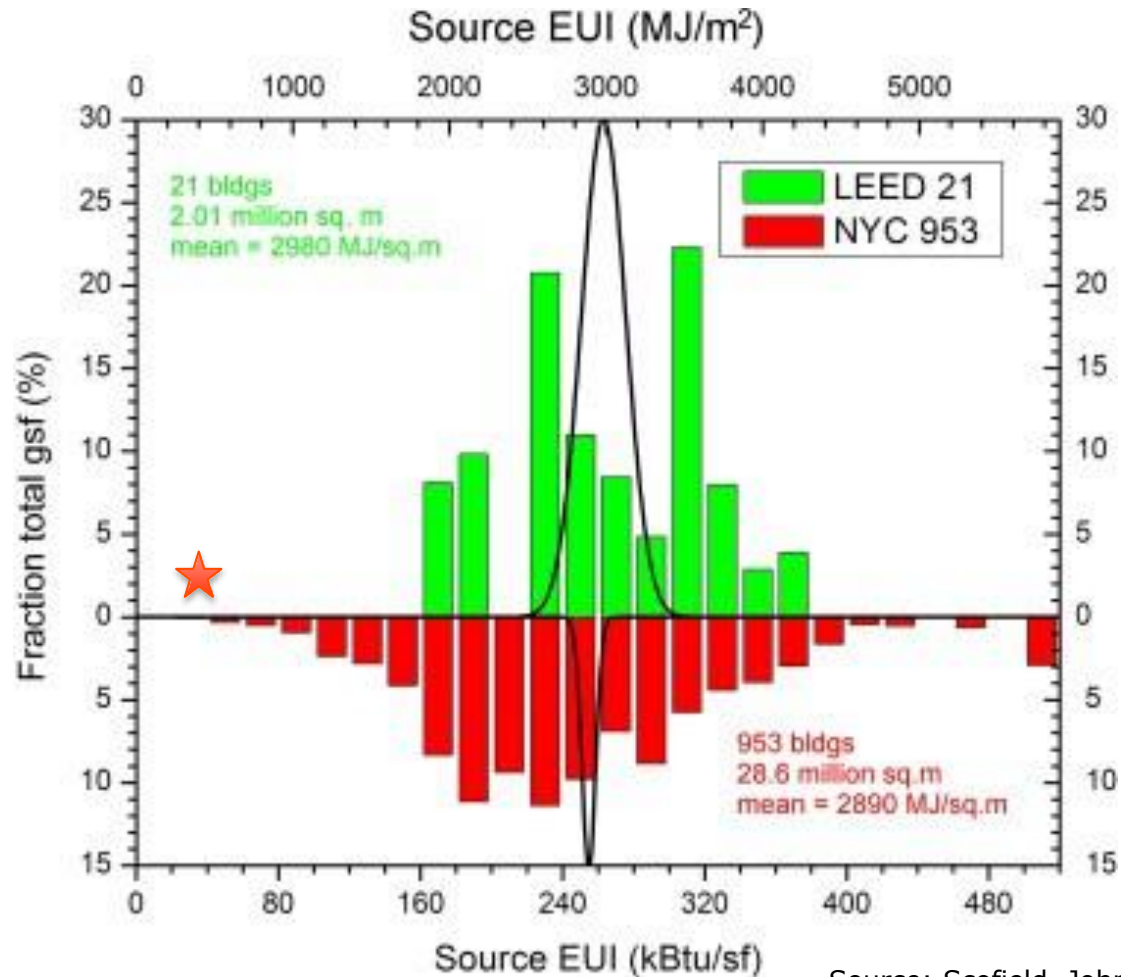


E Wing Hot Water (2015) Temperature

BUILDINGS – DAVIS CAMPUS



LEED BUILDING STUDY - 2013



Source: Scofield, John H. Efficacy of LEED-certification in reducing energy consumption and greenhouse gas emission for large New York City office buildings. *Energy and Buildings* (December 2013). Elsevier.

RESULTS – NEW BUILDINGS



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REGULATIONS AND STANDARDS *IMPACT* *QUALITY*



ASME B36.10	Welded and Seamless Wrought Pipe	EN 10216 EN 10217	Seamless Steel Pipe Welded Steel Pipe
ASTEM A53 ASTEM A106	Steel Pipe Seamless Steel Pipe		
ASTM F2165	Pre-Insulated Bonded Piping	EN 253 EN 448 EN 488 EN 489	District Heating Pipes District Heating Fittings District Heating Valves District Heating Joints
ASME B31.1	Power Piping	EN 13941 EN 14419	Design and Installation of District Heating Pipes Surveillance Systems

PIPING INSTALLATION BEST OF BOTH CONTINENTS ASME vs. EN STANDARDS

Temp = $< 100^{\circ}\text{C}$ (212°F)

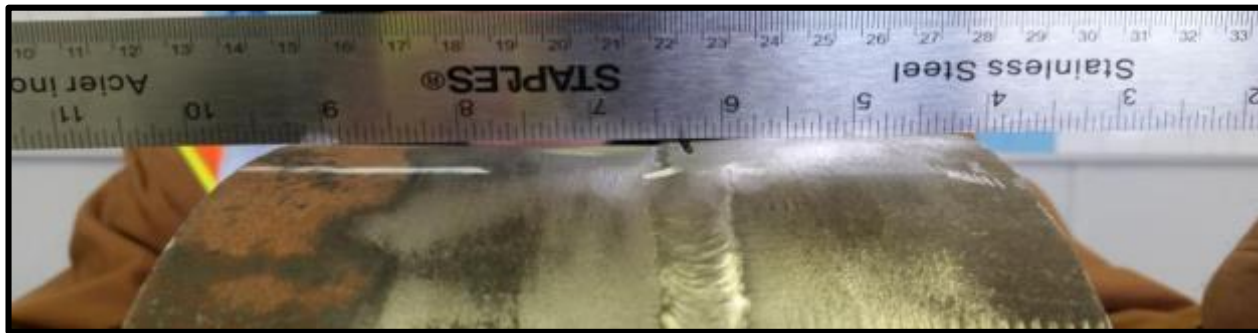
Pres. = < 10 bar (145 PSI)

Regulation: ASME B31.1 – Power Piping

- X-Ray not required
- Alignment to be within 2mm
- Hydrostatic pressure test to be 1.5 times the design pressure, held for 10 minutes, then reduced to design for leak test

Standard: EN 13941 – Design and installation of preinsulated bonded pipe systems for district heating

- X-Ray required on 10% of welds
- Alignment to be within 1mm
- Pressure test is not required, but weld leak tightness test of all welds is



Davis Campus District Energy Infrastructure



Trafalgar Campus District Energy Infrastructure




QUALITY CONTROL

[illegible]

No.	Subject of control	Reference	Control method	Time and frequency of control
Before start				
1	Digging permits			
2	Line information			
3	Sign and traffic planning			
4	Original conditions inspection & documentation			
5	Education / Occupational Health and Safety			
6	Work Schedule			
7	Proposal for QA - folder			
Material control				
10	Gravel quality			
12	Hot mix asphalt			
13	Other materials			
Process control				
14	Offset			
15	Excavation			
16	Shoring			
17	Handling of district heat pipes			
18	Marking net			
19	Backfilling			
20	Compression			
21	Paving work			
23	Asphalt pavements, hot mixed			
Final control				
24	Final walkthrough inspection delivery			

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Leak Tightness Test	QA doc. no.:

Project name:			
Project numbers:			
Pipeline system:	Installing Joint Casing QA doc. no.:		
Pipeline section:			
Reference to drawing:	Project name:	Date:	
Testing liquid:	Project number:		

Date:	Pipeline system:	RAMBOLL	
Ambient temperature:	Pipeline section:		
Air pressure:	Reference to drawing:		
Time:	Contractor:		
Pressure:	Fitter (name and initials):		
Placement of air pressure gauge:			
Supply:	Filed out by the Fitter		
Outlet:			
Acceptance of air pressure test:			
		Pipe Cleaning	QA doc. no.:
		Project name:	Date:
		Project number:	Author:
		Pipeline system:	
		Pipeline section:	
		Reference to drawing:	
		Date:	
		Surrounding temperature:	+°C =
		Air pressure:	Psi / Bar =

[illegible]

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SUPPLIERS



CONTRACTORS



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OWNER – LESSONS LEARNED

- Certified welding procedures as part of tender requirements
- Thoroughly investigate existing site conditions
- Single-person responsibility for material
 - Confirm proper use
 - Carefully track stock
- Know your contract rights, and theirs
- Site coordination is important

CONSULTANT – SITE INSPECTION



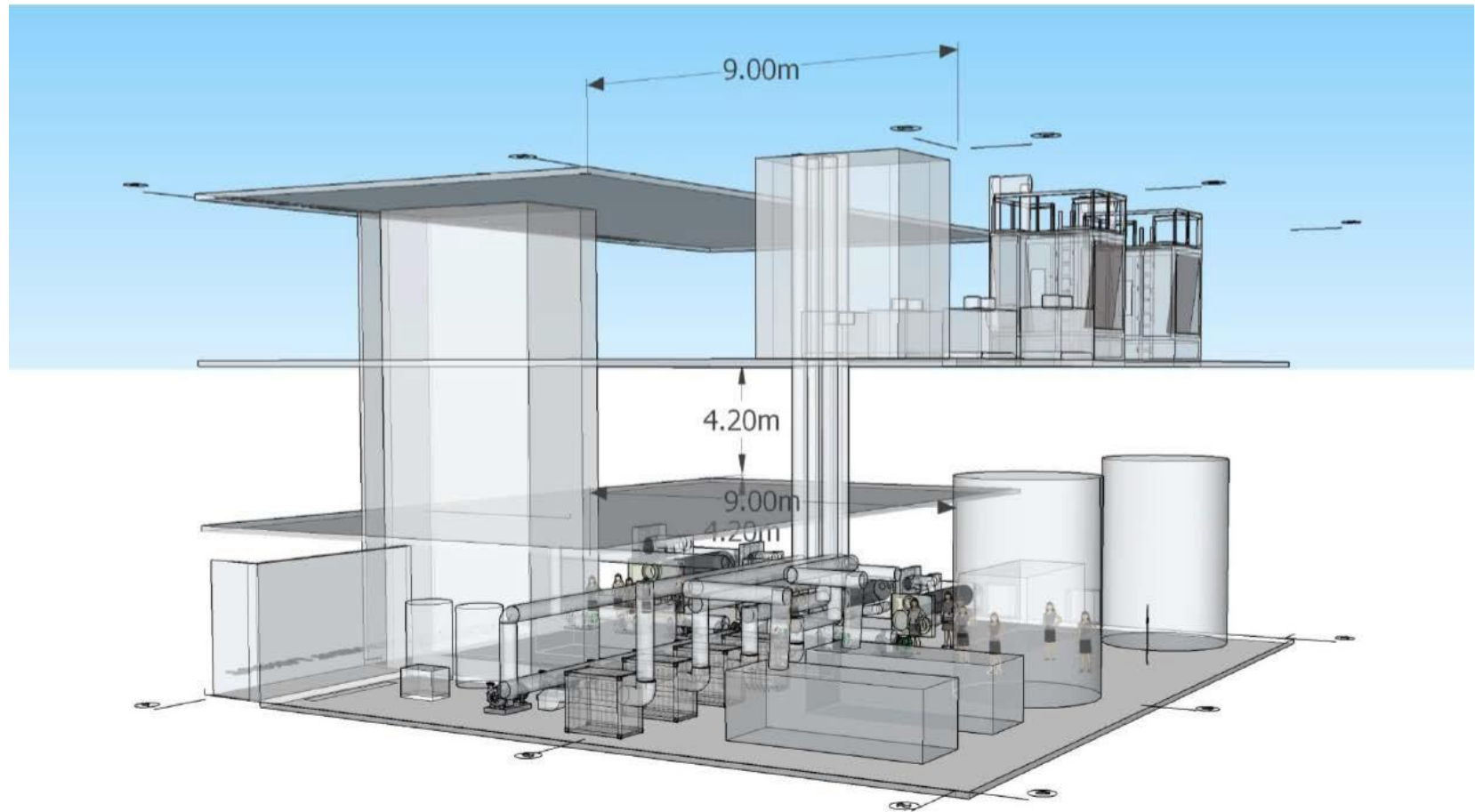
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ENERGY CENTRES & CONNECTIONS



SOLAR PHOTOVOLTAIC



Option: Solar PV

THANK YOU

QUESTIONS?

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**READ MORE ON OUR WEBSITE:
WWW.RAMBOLL.COM/ENERGY**