Materials Processing Institute

1944 - 2019 75 YEARS OF INNOVATION

WP7 Development of ThingWorx IIoT Platform

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What is an Industrial Internet of Things Platform?

- An Industrial Internet of Things (IIoT) platform brings together all of your manufacturing plant's data (sensors, control systems, databases etc) onto one server to create a digital representation of your whole process.
- This centralised platform approach speeds up the design and deployment of data visualisation, AR/VR, condition monitoring, performance analytics, machine learning and embedded mathematical modelling ('digital twinning') to your manufacturing process.
- Such digitally connected manufacturing processes are sometimes known as Cyber-Physical Systems.

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WP7 Development of ThingWorx IIoT Platform

- Objectives

1. Data Ingestion: Verification and pre-processing
2. Data Display: Dashboards for all types of use case and user.
3. Edge Applications: Create custom applications for non-connected devices.

- Deliverables

1. Live dashboards for connected machines on the Normanton Plant.
2. Edge applications to connect legacy instrumentation to the ThingWorx platform.

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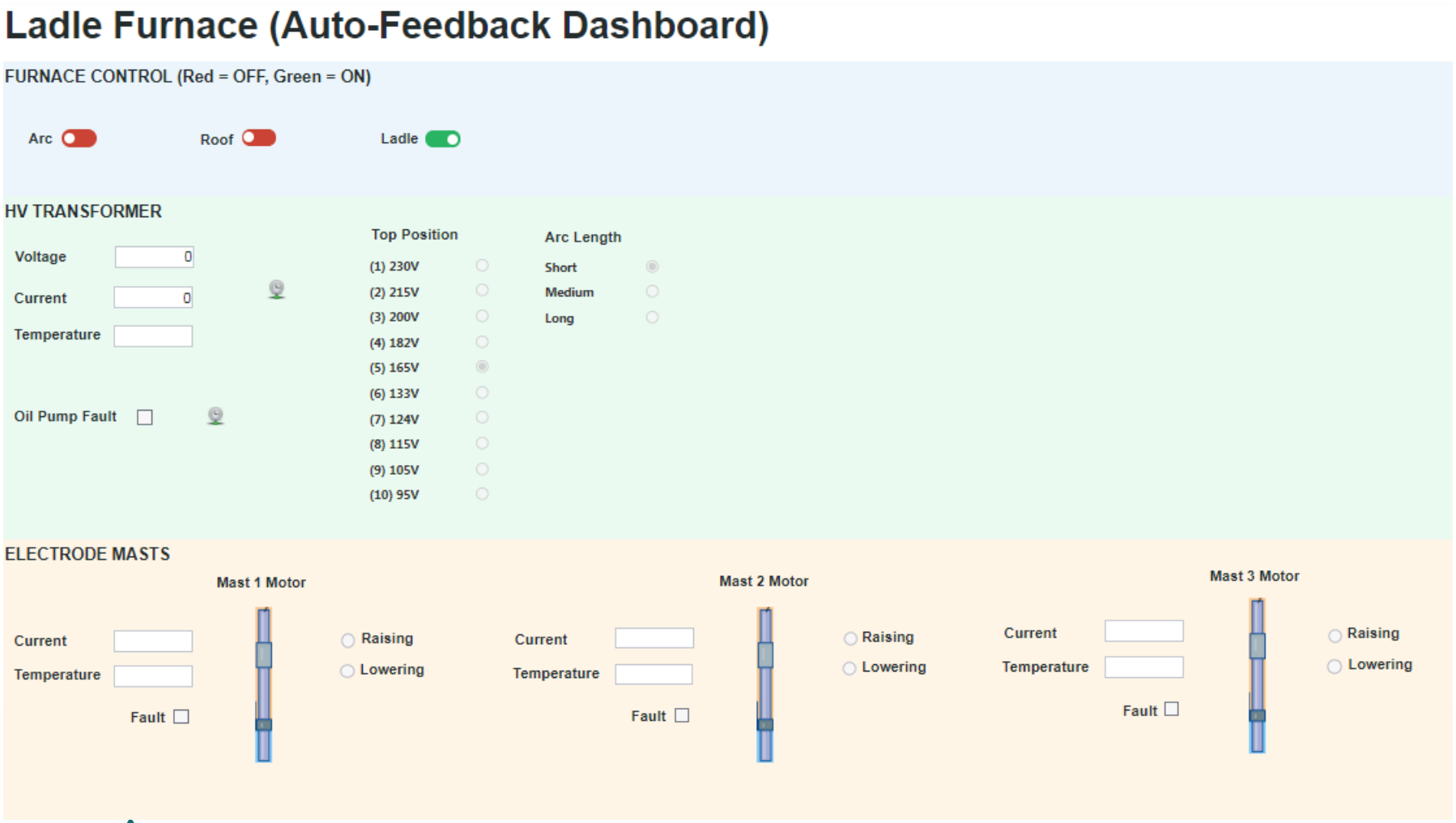
WP7:1 - Data Ingestion

- Data integrity is the foundation of an IIoT platform. When dealing with legacy systems with little documentation this is a time-consuming process.
- The plant has three machines (‘things’ in ThingWorx) that stream process signals to a Kepserver database that ThingWorx reads. Thousands of signals are in the PLCs, a few hundred are required to be found, tested and calibrated.
- Done for two of the three ‘things’ EAF & CCM, a few logic signals to finalise for LFVTD.
- Once data signals are ThingWorx, many need pre-processing before they can be used.
- Error checking, scaling to the correct units, computation of running & daily metrics.
- This has been done for the EAF & is ongoing for the CCM.
- A specification for the Heat Transfer calculations in the casting mould has been written and will be the next running calculation entered into ThingWorx.
- Liquidus & Additions calculations to do after this and then LFTVD.

WP7:2 - Data Display



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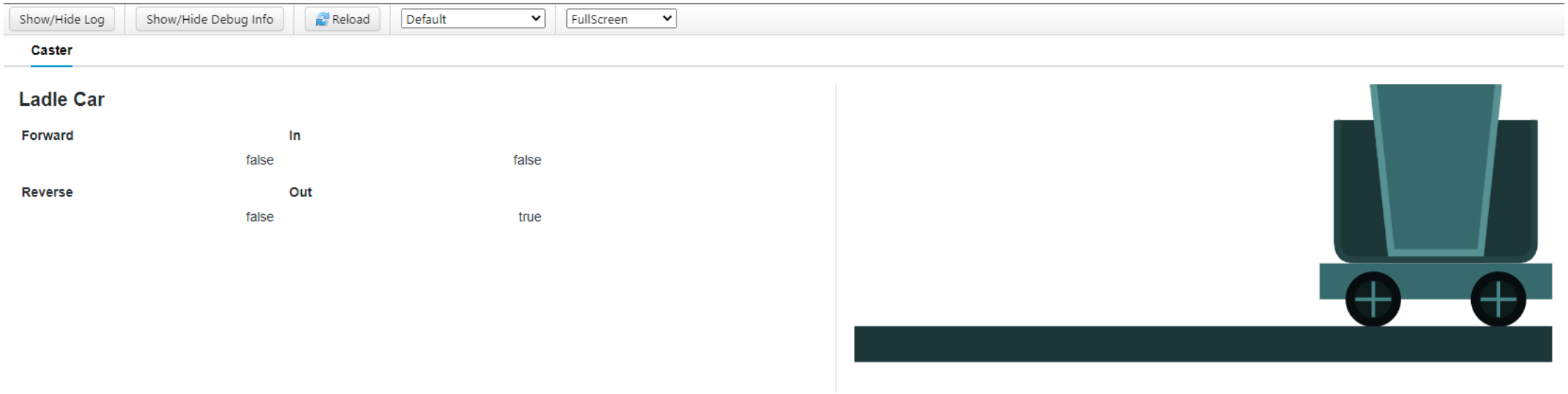
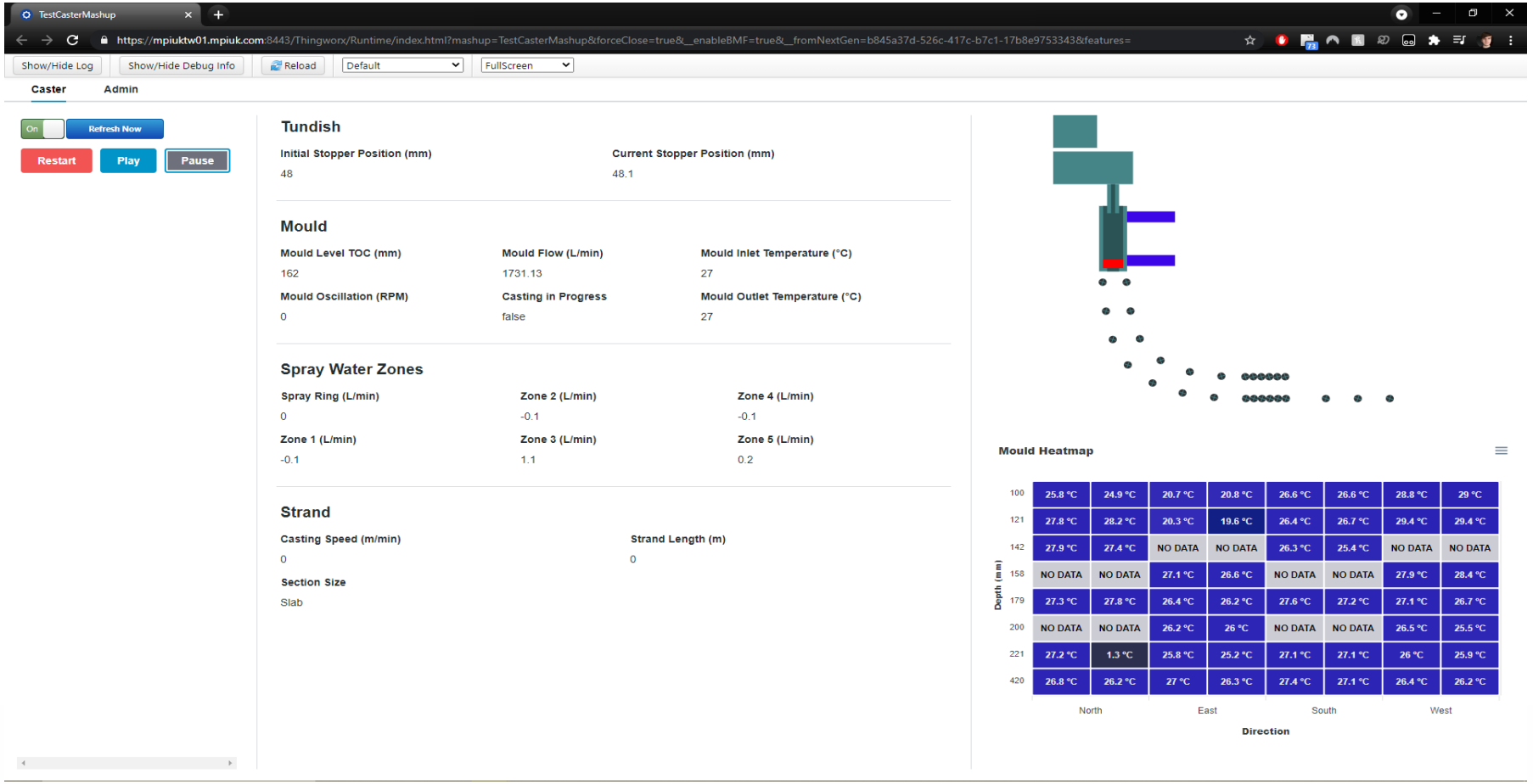
WP7:2 - Data Display



WP7:2 - Data Display



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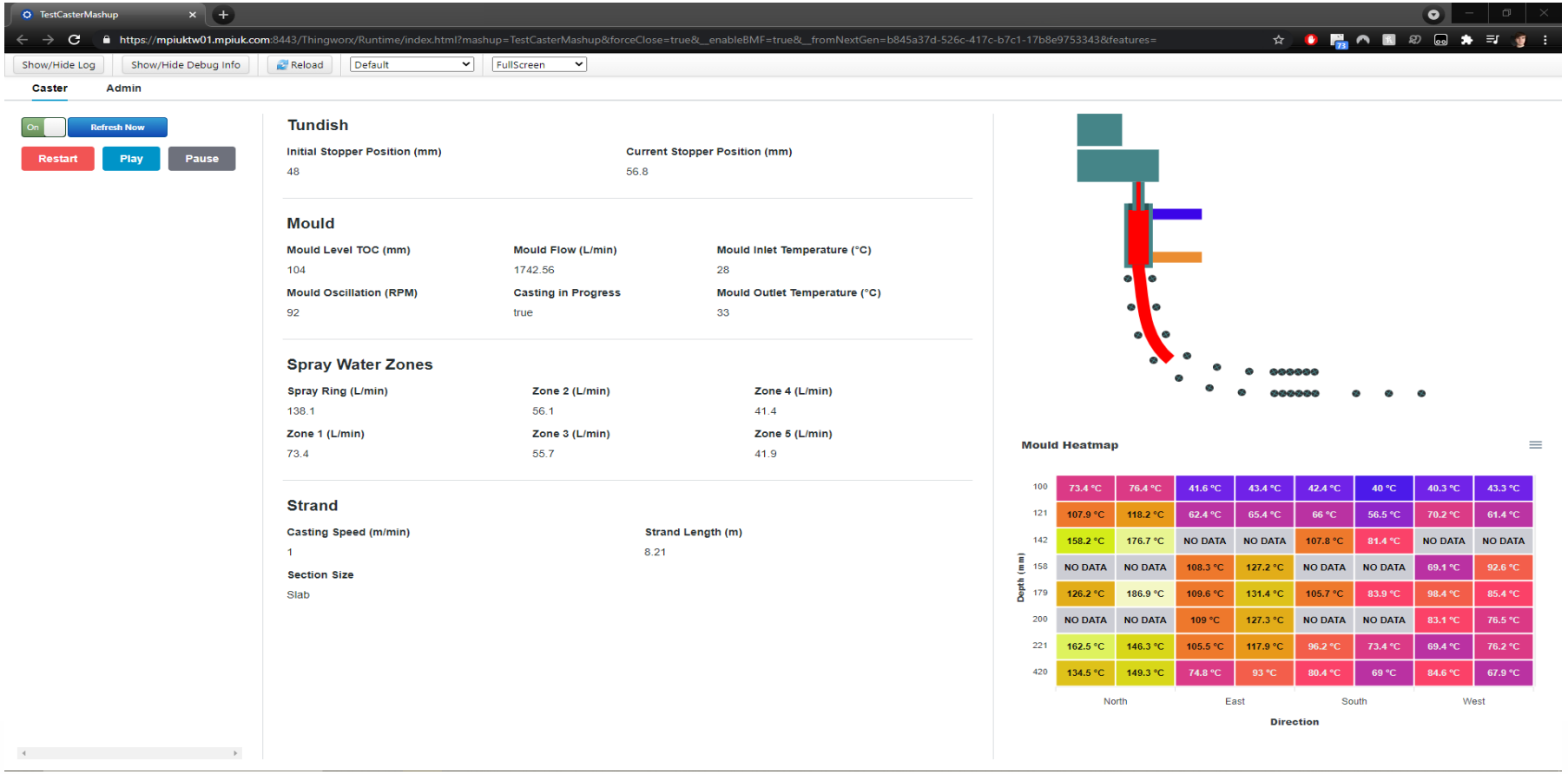

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WP7:3 – Edge Applications

- Plant uses an Optical Emission Spectroscopy machine to test the chemical specification of a melt.
- Machine is antiquated and only outputs in a poorly formatted text file.
- Python code written to decipher text file and pull chemical specifications of each element out into table.
- Table of elements pushed to ThingWorx each time machine updates file via the REST API.

Export Old OES Analysis Data

ID_N...	Year	Stand...	Descr...	C	Si	Mn	P	S	Cr	Ni	Mo	Al	Cu	Co	Ti	Nb	V	W	Pb	Mg	B	Sb	Sn	Zn	As	Bi	Ta	Ca	Ce	Zr	La	Se
070224(	B2015	LOW	Mon 6	0.158	0.195	0.93	0.068	0.061	0.207	3.77	0.109	0.067	0.451	0.066	0.027	0.032	0.417	0.269	0.001	0	0.0012	0.001	0.044	0.0037	0.001	0.0047	0.021	0.0003	0.003	0.022	0.0003	0.045
070224(	B2015	LOW	Monitor 5	0.86	0.84	0.359	0.012	0.028	3.05	0.119	1.45	0.188	0.111	0.291	0.122	0.056	0.136	0.129	0.001	0	0.0012	0.001	0.0076	0.0094	0.001	0.015	0.007	0.0001	0.0031	0.0014	0.0005	0.043
070224(	B2015	LOW	CRM 097	0.0091	0.0002	0.0065	0.0016	0.0021	0.0015	0.0027	0.0001	0.0005	0.0016	0.0014	0.0005	0.0013	0.0009	0.011	0.001	0	0.0009	0.001	0.0005	0.0033	0.0044	0.0068	0.007	0.0004	0.002	0.0016	0.0003	0.031
070224(	B2015	LOW	NASAB F	0.015	0.0068	0.0029	0.0016	0.0074	0.004	0.0079	0.0001	0.0005	0.0029	0.0023	0.0005	0.0014	0.0009	0.01	0.001	0	0.0007	0.001	0.0008	0.0035	0.0017	0.0073	0.007	0.0001	0.002	0.0015	0.0003	0.032
070224(	B2015	LOW	Heat 449	0.087	0.0002	0.142	0.0065	0.0042	0.062	0.049	0.033	0.214	0.028	0.0065	0.0005	0.0016	0.0022	0.0071	0.0047	0	0.0004	0.001	0.003	0.0033	0.0018	0.0082	0.007	0.0001	0.002	0.0025	0.0003	0.041
070224(	B2015	LOW	Heat 449	0.045	0.0002	0.063	0.0065	0.0042	0.049	0.051	0.034	0.166	0.029	0.0068	0.0005	0.0011	0.0013	0.007	0.005	0	0.0001	0.001	0.0031	0.0012	0.0016	0.0083	0.007	0.0001	0.002	0.0018	0.0003	0.046

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Smart Building Application

- Transform the campus to a Smart Building through the connection of meters, generators, lighting and heating to the IIoT platform for monitoring and control.
- This will lead to reduced cost and energy consumption and will align with the Institute's desire to become carbon neutral.

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