THE DEVELOPMENT OF A FUNCTIONAL SPECIFICATION OF A NEW MODEL, INTEGRATING BUILDING ENVIRONMENT AND MANUFACTURING PROCESS SIMULATION INTO ONE TOOL

dmu.ac.uk
DE MONTFORT UNIVERSITY
LEICESTER

Prepared by Michael Oates (moates@dmu.ac.uk) INSTITUTE OF ENERGY AND SUSTAINABLE DEVELOPMENT (IESD)

INTRODUCTION

The aim of the research is to develop a link between building environment and manufacturing process simulation with a view to integrating the two into one tool. This research will identify opportunities for improving the energy and resource efficiency of large scale industrial processes through the re-use of energy, industrial resources and waste flows, linking this to modelling the built environment and building services. This research forms part of the 'Through Life Energy and Resource Modelling' (THERM) project, in collaboration with Airbus, Toyota, Integrated Environmental Solutions (IES) and Cranfield University

Why is such a tool required?

- Large amounts of process energy exhausted to atmosphere
- Building structure and shop floor processes designed as separate entities
- Lack of understanding of sub-system energy consumption
- Increasing energy costs and diminishing natural resources

Description and functionality of the tool to:

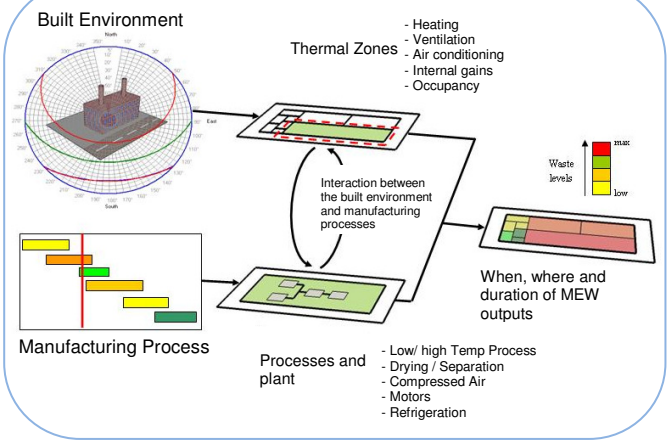
- Map and monitor the flow of, materials, energy and waste (MEW) associated with the building services and industrial processes
- Identify when, where and duration of MEW streams
- Improve building services and industrial process energy efficiency through integration of systems
- Identify opportunities for possible re-use of industrial resources and waste streams

PRELIMINARY CONCEPT

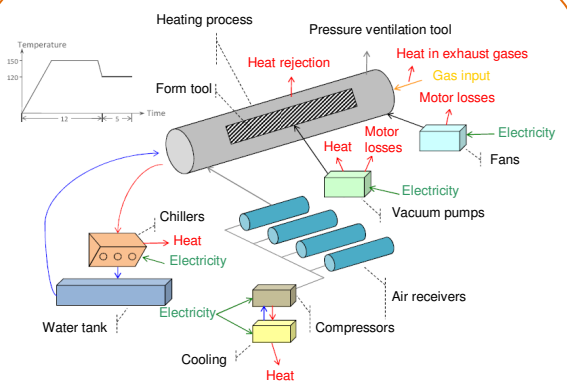
The preliminary concept (right) illustrates the interaction between building and manufacturing process simulation.

Built Environment	Manufacturing Process
• Weather driven	• Demand driven
• Zoning and activities	• Material flow
• Thermal analysis	• Bottle neck analysis
• Deterministic	• Stochastic

The concept integrates building simulation (usually dynamic simulation[1]) and manufacturing process simulation (usually discrete event simulation[2]) into one tool. The benefits of such a tool are a better understanding of process thermal flow on the built environment, process optimisation and identification of opportunities for possible re-use of industrial resources and waste streams.



INDUSTRIAL CASE STUDIES



Two large energy consuming processes have been identified as investigational case studies:

- Batch process (Aviation)
- Continuous process (Automotive)

Current work being undertaken:

- Identification and mapping of primary industrial process, sub-systems and their interactions (Left, aviation process illustration[3])
- Geometry and construction of built environment
- Monitoring process flow of energy and materials

Problems and limitations

- A lack of knowledge of sub-system interactions
- A lack of building data (Pre-1990 fabrication)
- Energy measured at macro level

RESEARCH METHODOLOGY

LITERATURE REVIEW

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IDENTIFICATION OF THE QUANTITATIVE AND QUALITATIVE DATA OF BUILDING ENVIRONMENT AND INDUSTRIAL PROCESSES

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MAP, MONITOR AND UNDERSTAND THE ENERGY AND OTHER FLOWS FROM INDUSTRIAL CASE STUDIES

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DEVELOPMENT OF A FUNCTIONAL SPECIFICATION OF A NEW MODEL, INTEGRATING BUILDING ENVIRONMENT AND MANUFACTURING PROCESS SIMULATION

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TESTING OF THE MODEL PROTOTYPE FOR INDUSTRIAL APPLICATIONS

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CONCLUSIONS WILL BE DRAWN ON THE MODELS APPLICABILITY IN MANUFACTURING INDUSTRY, POTENTIAL ECONOMIC AND ENVIRONMENTAL BENEFITS, AND FURTHER WORK

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ACKNOWLEDGEMENTS …

1st supervisor … Dr Andrew Wright
2nd supervisor … Dr Richard Greenough
THERM collaborators

EPSRC
Pioneering research and skills

Technology Strategy Board
Driving Innovation