

Technical Seminar Series Eco-Efficiency Grand Challenge Resource Efficiency in the Factory

16:00-17:00 5 February 2015











We will record this webinar and issue the recording afterwards

Slides will also be made available

Please use chat to raise questions throughout the presentations

Questions after this presentation finishes? Please contact Dr Mélanie Despeisse <md621@cam.ac.uk> **Technical webinar series – schedule** 5 FEBRUARY 2015

- **Today:** Eco-Efficiency Grand Challenge: Resource Efficiency in the Factory
- Next month: Eco-Factory Grand Challenge: Optimisation, Rationalisation and Resilience Tools
- Future months: much more to follow!!
- ... and it could be you...
- Typically first Thursday of the month











Technical webinar series – the aims 5 FEBRUARY 2015

If you have interesting content to share from research and development, good practice, valuable results in practice, etc then perhaps you should be scheduled in the series.

Contact Sharon Mey cisadmin@ eng.cam.ac.uk Sharing research results and industrial practice for Centre members

• **Connecting people** within the Centre as outside the Centre

 Providing feedback, comments, suggestions, refinement, etc to those presenting













How is the Centre structured?





Eco-efficiency

Reducing resourse use (water, energy, materials) Improvements without radical changes to product or process





Eco-factory Increasing added value and improving production capability and responsiveness Decreasing consumption of natural resources





Sustainable Industrial System Exploring future configurations of the industrial system and their implications Taking first steps to improve understanding of the long term challenges facing industry











How the Centre works - Impact

WEBINARS ... CONTRIBUTING TO SHARING OUR KNOWLEDGE

Educating the Leaders of Tomorrow TODAY

Bigger **Impact**, faster, wider, sooner

Sharing Knowledge

Building & Sharing a Vision



lege Loughborough University









Some members of the eco-efficiency grand challenge team:

Dr Peter Ball p.d.ball@cranfield.ac.uk

Dr Mélanie Despeisse md621@cam.ac.uk

Aanand Davé a.dave@cranfield.ac.uk

Simon Roberts simon.roberts@cranfield.ac.uk

Eco-Efficiency Grand Challenge: Resource Efficiency in the Factory 5 FEBRUARY 2015

- 16.00 Introduction (Peter)
- 16.10 Overview of Grand Challenge (Mélanie)
- 16.20 Modelling (Aanand)
- 16.35 Engagement (Simon)
- 16.50 Wrap up (Mélanie)
- 17.00 Close





















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What is eco-efficiency?

DEFINITION – THE CONCEPT

DO NORE WITH LESS











The Eco-Efficiency Journey

THE FIVE KEY COMPONENTS



What is your waste worth? Decide to take the journey towards eco-efficiency and learn to see waste.



How can you do more with less? Find solutions, from quick wins to more advanced tactics for resource efficiency.



What's the size of the prize? Understand potential benefits and set targets.



Where are you now? Assess your current performance and benchmark yourself.



Where to from here? Identify improvements in a systematic way, take action and make it a routine activity.













and skills



Have you seen performance variation?













Have you seen performance variation?



A variation of up to 500% was observed between worst and best performing factories manufacturing similar products with similar technology.



75,546 kcal/kg of chocolate



12,591 kcal/kg of chocolate











Have you seen performance variation?

A LESSON FROM THE BEST IN CLASS

Toyota Motor Europe: leaning on production

















Understanding eco-efficiency though environmental performance benchmarking

A qualitative approach

Lampros Litos II443@cam.ac.uk











Energy Inputs & Outputs

roduction Volume

(kWh/hl)

Sai Gon Beer exclu

Energy

FY 08 FY 09 FY 10 FY

Environmental performance in factories

3 OPERATIONAL AREAS TO LOOK FOR IMPROVEMENTS

- Wider system re-configurations and long term planning
 - System re-configurations (OneSteel)
 - Multi-stakeholder engagement
- Extended improvement mechanisms and capabilities
 - Process and product design
 - CSR reporting (TOYOTA)
 - ISO standards implementation (ISO 26000, ISO 50000)

Technology advances and investment

- Investment in newer technologies based on planning (Darigold)
- Cleaner production projects

A Vietnamese beer producer spending 100% more energy and water than his German competitors

Lampros Litos II443@cam.ac.uk

Sai Gon Be











Capability Assessment Grid for Eco-efficiency (C.A.G.E.) MATURITY-BASED ASSESSMENT TOOL

MATURITY MODELS

To drive research



- Scales and process areas of application
- Progressive and stepwise improvements
 - 5 maturity levels
 - 15 process areas of improvement
 - 3 scales of operations (color coded)
 - Cell context is mainly descriptive



and skills



Capability Assessment Grid for Eco-efficiency (C.A.G.E.)

RESEARCH METHODOLOGY AND APPLICATION

Early findings





SEMI-STRUCTURED

PEERS' WORKSHOP



Lampros Litos *II443@cam.ac.uk*



Cranfield



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Engagement and best practices

Turning best practices into habits

Simon Roberts simon.roberts@cranfield.ac.uk











Learning how to make more out of less

• How do we learn about practice?

• Who do we engage?

• How can we break out of a "routine" ways of working.. and encourage others to do so?

Simon Roberts simon.roberts@cranfield.ac.uk











Learning how to make more out of less

• When do champions learn?

- When adopting new manufacturing standards
- When interacting with other teams e.g. engineering & production
- When they become aware of new practices (spotting differences/variation)

Simon Roberts simon.roberts@cranfield.ac.uk











Can we get better at learning?

• Problem: US energy audits implementation rate <50%



• Is this really just about technical and economic issues?

Can we improve the ways in which champions learn about industrial sustainability?

Ask me if you want to link to this resource

Simon Roberts simon.roberts@cranfield.ac.uk











What are practices?

Competences:

- Technical expertise,
- Familiarity with production systems and operating constraints,
- Data analysis techniques,
- Understanding of environmental performance metrics and common assumptions in calculations

Equipment:

- Utilities and factory infrastructure
- Environmental metering
- Building Fabric
- Data Acquisition and monitoring

Meaning:

- Meeting or exceeding environmental performance targets
- Working towards redefining the minimum non-labour resource requirements for an activity
- Accountability and recognition important to motivate different groups
- Sensitivity in specifying improvements to groups not aware of the opportunity

Simon Roberts simon.roberts@cranfield.ac.uk











New practices are rarely completely novel, usually there are pre-existing elements that need to form new links in order to be adopted.



Simon Roberts simon.roberts@cranfield.ac.uk







Imperial College London



Engagement Opportunity LEARNING HOW TO MAKE MORE OUT OF LESS

2deg°rees

Simon Roberts simon.roberts@cranfield.ac.uk











Factory Eco-Efficiency Modelling The FEEM framework Aanand Davé a.dave@cranfield.ac.uk $\bigcirc \bigcirc \bigcirc \bigcirc$







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- 1. An operational resource modelling framework
- 2. For managing assets to make informed decisions
- 3. An aid in practical implementation and paybacks









Ways to use FEEM





Cursory Model: Site Facilities Level



Shows energy & material flows, Justifies detailed analysis, Links resources to production profiles, Defines simulation control logic

Aanand Davé a.dave@cranfield.ac.uk UNIVERSITY OF CAMBRIDGE



and skills





Detailed Model: MFG Cell Level















Simulation Results Example



Resource eco-efficiency baseline model is built and experimented upon using simulation to provide resource saving opportunities

Aanand Davé a.dave@cranfield.ac.uk UNIVERSITY OF CAMBRIDGE





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Modelling Indicators Example

Zone Water Footprint

Water footprint is measures direct and indirect uses in terms of % water volume consumed, evaporated and/or polluted, in a given range or time period. These types of footprints can be split into 4 main types: Blue: surface water evaporated by process or incorporated into a product. Green: rainwater harvested for active use. Grey: freshwater to dilute pollutants & Black: Sewage







MFG Cell Power Factor

This example shows the Power Factor (\emptyset) heat and target map for each MFG cell across the factory. Anything <0.9 \emptyset is considered to be below the target set by the company. Hitting this target is important to save the company additional utility charges



Aanand Davé a.dave@cranfield.ac.uk







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Reasons for Using FEEM













CIMIS FEEM Partners & Collaborators



If you'd like to learn more: www.industrialsustainability.org

Aanand Davé a.dave@cranfield.ac.uk













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