Services for Business Programme

Site Visit Report for

Rottapharm Madaus

Damastown Industrial Estate

Mulhuddart

Dublin 15

Prepared by Liam Tolton

20 May 2009

SEI Client ID: 1234

Executive Summary

Liam Tolton carried out a half day energy assessment at the Rottapharm facility at Damastown ,Dublin 15. The site is a modern finished pharmaceutical production plant undertaking the packaging of a range of pharmaceutical sachet, tablets, caplets and capsules. The plant employs ca. 130 people normally operating on a 5 day, 2 shift with occasional 3 shift production.

There are a number of opportunities for energy conservation in the electrical and thermal energy used on the site. These opportunities may yield savings of 5 to 10 % on energy consumed representing savings of €40 k to €80k per annum depending on the degree of implementation of the recommendations of this report. This, in turn, will depend on the implementation of a structured energy management system based on the principles of Energy MAP. (Management Action Plan).

The site should consider that it is starting out on a journey which may take 1 to 2 years to complete before a fully operational energy management system is in place on site. The fact that the company is used to structured management systems in the quality and safety aspects of its business should mean that the implementation of an energy management system should be very feasible.

Site management has already set up a team to implement an energy management system on site. Part of the remit of this team should be to implement an energy awareness program among the staff to help indentify and reduce energy losses throughout the site.

There are a number of actions which should be taken immediately to reduce energy consumption:

- Review all defective insulation and repair / replace as necessary.
- Implement a monitoring programme to measure and report on energy consumption on a monthly basis.
- Re-commission defective sub-meters and institute reading of all sub-meters on site.
- Review the operations of the chiller systems to determine if they can be improved to reduce the impact of these large energy consumers.

The energy team should try to identify the main drivers of energy use on site using the correlation analyses presented later in this report as a basis for this exercise. It is clear from the initial results that electrical energy consumed is not correlated with production volumes. The thermal energy used is strongly correlated to weather conditions as expressed by degree days. This suggests that there are other drivers of electricity use as yet not determine. It may be that the large utility systems determine the main electricity usage. It may also be the case that the production support systems are not

shutdown when production operations cease. This may be an area for further study to determine if significant savings may be made by operating equipment only precisely when it is required.

The site has significant potential for energy savings which can be best achieved by a structured implementation on an energy management action plan as outlined in this report.

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1 Introduction

1.1 Site Visit

Organisation Name:	Rottapharm (Ireland) Ltd.
Site Name & Address:	Damastown Industrial Estate , Mulhuddart, Dublin 15
SEI Client ID:	1234
Date of Visit:	26/02/09
Duration of Visit (h):	4 hrs
SEI Energy Advisor:	Liam Tolton
Visit Hosted By:	Conor Campion – Project Engineer

Liam Tolton undertook a site visit of the Rottapharm site at Damastown under SEI's Services for Business Programme. The site is a modern finished pharmaceutical manufacturing facility with associated warehouse and admin/ laboratory facilities.

This report has been prepared with all reasonable skill, care and diligence and summarises the findings from the half-day site visit.

All values quoted in this Report are based on information provided by the Client. All values quoted for energy savings are estimates and may require additional detailed investigation to confirm their validity.

1.2 Description of Site

The site comprises a main production area with warehousing and offices attached. The equipment is modern with clean room areas in certain sections of the facility. The site employs ca. 130 people working on 5 day 12 hour basis. The production plant output comprises a range of finished pharmaceuticals in sachet, tablet, capsule and caplet formats. The site is undergoing an expansion at present with the installation of additional processing facilities. This has required the site to apply for an EPA IPPC license and to install a Regenerative Thermal Oxidiser to meet the new license conditions on air emissions. This unit was selected using energy conservation as one of the selection criteria. The unit will be fitted with a heat recovery system to recover waste heat from off gases for reuse to heat boiler water.

1.3 Client's Objectives

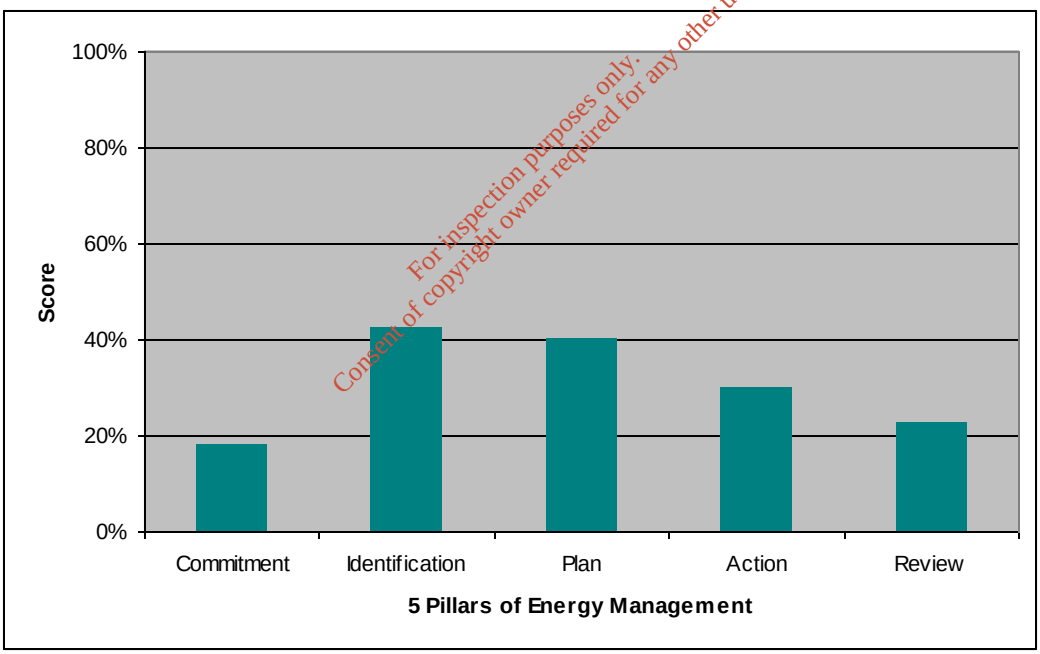
The objective of the client is to reduce the impact of increasing energy costs on the plant operations consistent with protection of the environment as required under EPA licensing.

2 Energy Management

Energy management is an all-encompassing process that should include every aspect of an organisation from finance, human resources and public relations to maintenance, purchasing and planning.

An Energy Management Diagnostic Questionnaire was completed for the site; the completed questionnaire is included in Appendix A. Rottapharm scored 30 % overall on this diagnostic. This score is at the high end of the average for organisations commencing work on energy management systems and should show dramatic improvement over the next 6 months as the recommendations from this site visit are put in place. Figure 1 shows the breakdown of the score between the five pillars of energy management.

Figure 1: Breakdown of Energy Management Diagnostic Score



The breakdown across the main pillars of energy management is quite typical with the emphasis on developing project based solutions. There are low levels in the commitment pillar as the formal systems are not yet established to encourage the commitment needed to implement a full and effective energy management system. There is little structured review of energy management in place as shown above.

The principal barriers to developing, implementing and maintaining a full and effective energy management system at the site are the availability of resources due to the concentration on the current expansion and lack of information on how to manage energy. These are again quite typical of organisation starting out on the journey of implementing effective energy management systems.

There is additional information available on energy management from SEI's Energy MAP website at www.sei.ie/energymap.

3 Energy Consumption

3.1 Annual Consumption

The main sources of energy for the site are electricity and natural gas. Electricity is purchased from Energia and Natural Gas from Bord Gais.

Rottapharms' annual energy consumption is set out in Table 1 and summarised in Figures 2 and 3.

Figure 2: Breakdown of Energy Consumption

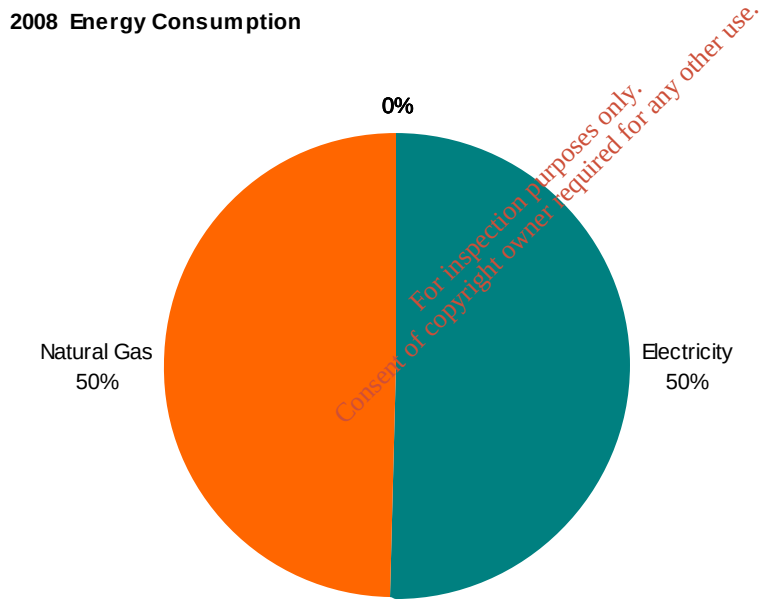


Figure 3: Breakdown of Energy Spend

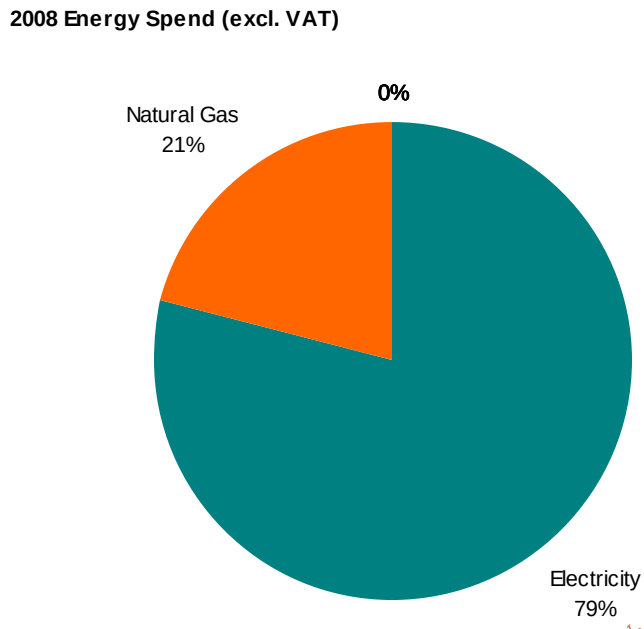


Figure 4: Breakdown of Energy Related CO_2 Emissions

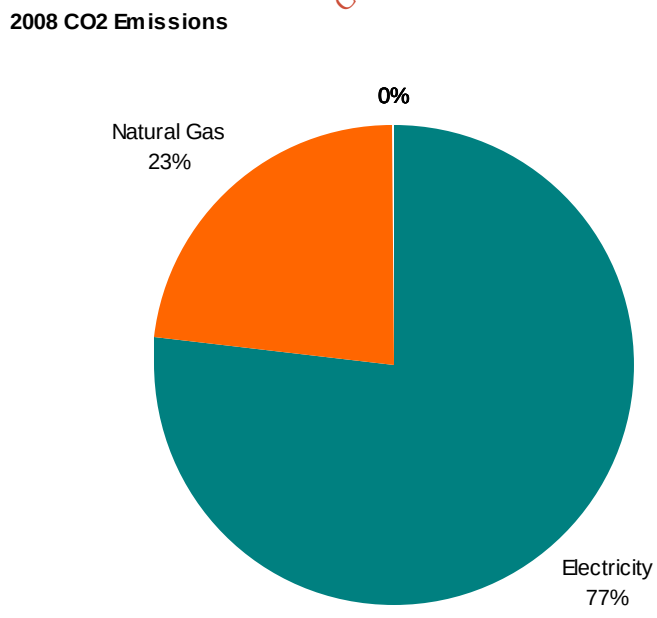


Table 1: Annual Energy Consumption & Energy Costs

Fuel	2008						Additional Information
	Quantity [kWh]	Spend (excl. VAT)	CO2 Emissions [t]	Quantity [kWh]	Spend (excl. VAT)	CO2 Emissions [t]	
Electricity Imported	4,374,567	€632,390	2,786.6				Data based on 11 months extrapolated to 12 months
Electricity – onsite Generation (CHP etc.)							
Electricity Exported							
Natural Gas	4,311,821	€170,184	853.7				Data based on 12 months of bills
LPG							
Fuel Oil (HFO / MFO)							
Kerosene / Gasoil							
Solid Fuels							
Renewables							
Fleet							
Total	8,686,388	€802,574	3,640.3				

3.2 Main Energy Consumers

The main energy consumers at the site are summarised in Tables 2 & 3 below. During a short site visit it was not feasible to determine the break down of energy consumed across a large site. I have noted here the areas where site personnel should commence estimation to determine the approximate split across the significant energy users on site.

Table 2: Summary of Primary Electrical Energy Consumers

Electrical Energy Consumer	% of Total	Comments
Lighting		
Heating, Ventilation / Air Conditioning		These are extensive and include clean room operation
Production Equipment		
Compressed air		
Office / Labs		

Table 3: Summary of Primary Thermal Energy Consumers

Thermal Energy Consumer	% of Total	Comments
Space Heating	50 %	
Hot Water Heating	4%	Estimated
Process	46%	Based on regression model intercept (ca.165000kWh/month)

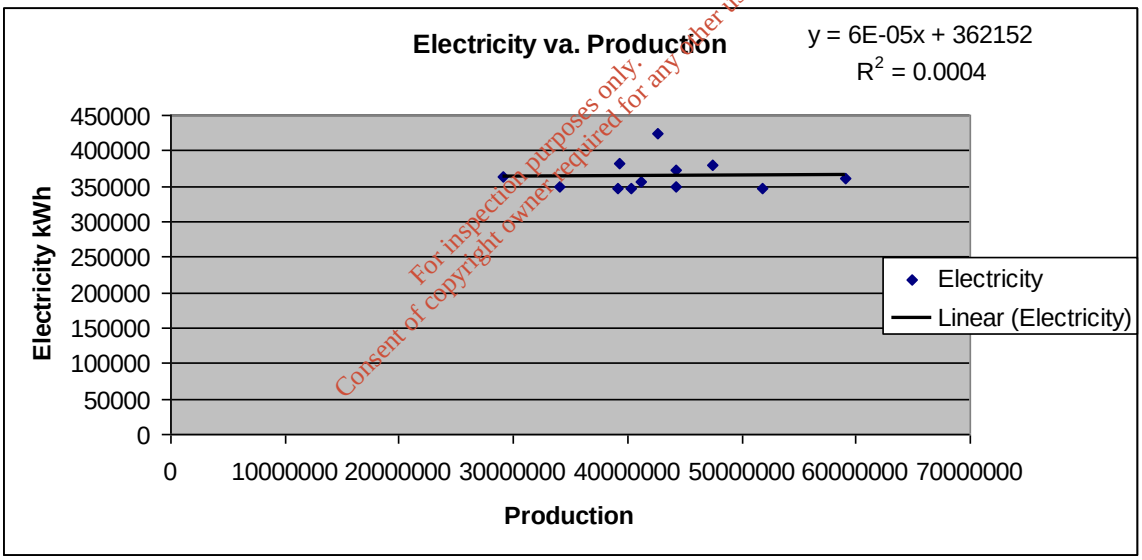
3.3 Energy Performance Indicators (EPIs)

The site does not currently monitor an Energy Performance Indicator. It is suggested that an EPI based on Energy per 1000 production units be initiated and monitored on a weekly basis. The overall data for this EPI for the period examined is shown overleaf:

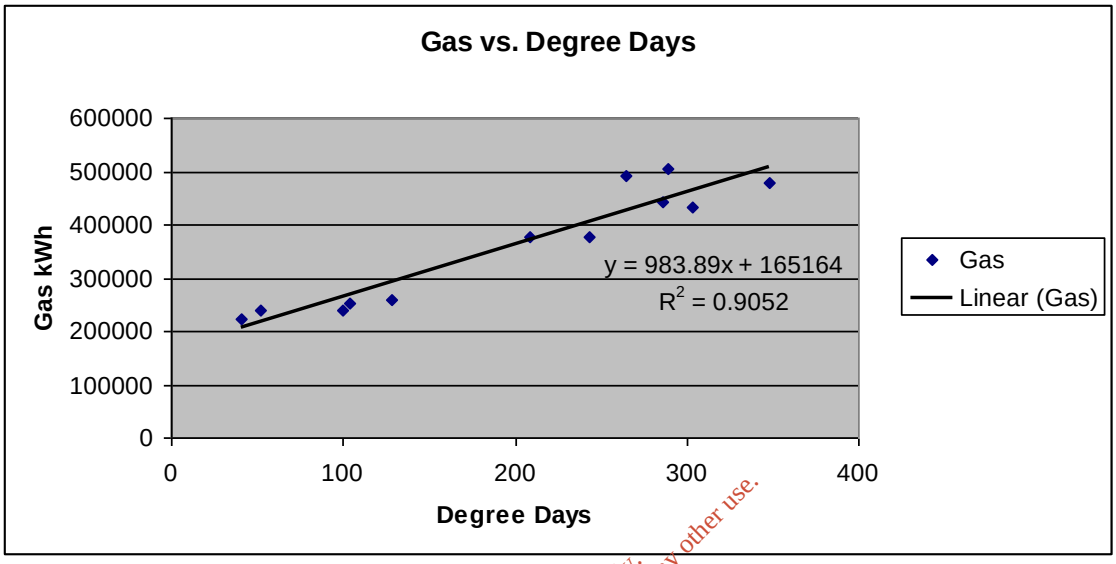
Ref	Type	Energy Performance Indicator (EPI)	2008 Value	Comments
01	Electrical	Electricity per 1000 units of output	8.54	This EPI is of very limited use as there is virtually no correlation between electricity and output
02	Thermal	Gas Usage per Degree Day	1,820.90	This is a reasonably useful EPI as there is a good correlation between gas and degree days albeit there is a relatively high fixed amount of gas consumed at ca. 165000 kWh / month

This EPI may be of limited use as there is effectively no correlation between electricity use and production. However, as the site commences reading submeters it may emerge that some of the production energy data may correlate more strongly with output.

The overall correlation of electricity is non existent as may be seen below.



In the case of thermal energy the correlation to Degree Days is very strong with over 90% of the variation in thermal energy being explained by the Monthly degree days. This is shown in the graph below:



This graph also shows that ca. 165,000 kWh are used per month that are not lined to degree days. This is a reasonable estimate of the process related use. While on face value these would suggest that EPIs based on production would not be useful, it is my view that they are still worth monitoring on a more regular (weekly basis) to help develop understanding of the degree to which the energy values vary on a weekly basis.

The above regression analyses also suggest that there is a lot of opportunity to determine what else drives energy consumption on the site. Some of these drivers may be waste occasioned by inappropriate operation of equipment and systems when no production is taking place in the certain areas. Elimination of energy waste and other losses may then improve the correlation to the extent that production output may be a stronger driver than the above analyses suggest at least when correlated to energy consumed by production equipment alone.

4 Opportunities for Energy Savings

4.1 Recent/Existing Energy Saving Initiatives

The site has carried our some recent initiatives including replacement of high bay lights with more efficient units and an energy audit that evolved to become a Combined Heat and Power assessment. I suggest that this audit be reviewed to determine if there are other opportunities that may arise from the work undertaken at that time.

4.2 Suggested Opportunities for Energy Savings

We identified a number of opportunities for further energy savings at the site; these are summarised in Table 4 overleaf. Any values quoted for energy savings are estimates and would require further investigation to verify their accuracy.

Table 4: Opportunities for Energy Savings

Ref	Opportunity	Indicative Benefits	Cost Range	Category	Target Date	Additional Information	Status
01	Formalise the appointment of a senior manager as energy champion	Increased management commitment	No / Low	Organisational	3 Months		
02	Write and Energy Policy	Increased management commitment	No / Low	Organisational	3 Months		
03	Publish the Energy Policy	Increased Staff Awareness	No / Low	Organisational	3 Months		
04	Institute quarterly reviews of consumption with the Energy Champion	Increased focus	No / Low	Organisational	6 Months		
05	Institute Annual reviews of energy management with the Energy Champion	Increased focus	No / Low	Organisational	12 Months		
06	Review the previous Audit / CHP assessment	identify opportunities	No / Low	Technical	3 Months		
07	Consider purchase of a 3 phase energy analyser	Increased Monitoring and Targeting	Medium	Technical	3 Months		
08	Determine the drivers of energy usage on site	Improved focus	No / Low	Technical	3 Months	Initial results suggest there is no correlation with production. There is a strong correlation between gas and weather conditions	
09	Set a formal target for energy reduction based on kWh	Improved focus	No / Low	Organisational	3 Months	5 % should be the minimum chosen	
10	Develop a register of opportunities based on this list and the list of ideas already generated on site	Input to an EM plan	No / Low	Organisational	3 Months		
11	Implement a staff energy awareness programme	Increase staff awareness	No / Low	People	6 Months		

12	Consider joining a sector based Energy MAP programme when one commences	Increased competence	No / Low	People	When Opportunity Arises		
13	Review all new projects from an Energy Efficient design perspective using life cycle costing	Long term energy reduction	No / Low	Technical	When Opportunity Arises		
14	Develop EPIs for the site based at machine / line level	Improved Monitoring and Targeting	No / Low	Technical	6 Months	There is no correlation at site level for electricity. There is strong correlation for Gas vs. Degree Days	
15	Complete the work on a formal monthly energy reporting system	Improved Monitoring and Targeting	No / Low	Organisational	3 Months		
16	Review adequacy of MIC level as new project starts up.	Potential penalty avoidance	No / Low	Technical	6 Months		
17	Set up on line billing with Electricity Supplier	Improved Monitoring and Targeting	No / Low	Organisational	3 Months		
18	Add power factor check to weekly checklist	Potential penalty avoidance	No / Low	Organisational	3 Months		
19	Review tariff to understand the electricity price increase in late 2008	Improved focus	No / Low	Organisational	3 Months	Review this on line comparing month on month costs	
20	Review options to retender electricity supply	Reduced Costs	No / Low	Organisational	6 Months		
21	Review fixed gas vs. variable gas tariff structure	Reduced Costs	No / Low	Organisational	3 Months		
22	Commence Reading / recording Gas Usage weekly	Improved focus	No / Low	Organisational	3 Months		
23	Consider options for heat recovery / recirculation in the building	Improved efficiency	High	Technical	6 Months		
24	Consider options to improve the control of existing heating systems	Improved efficiency	Medium	Technical	6 Months		
25	Consider improved control of chilling units	Improved efficiency	Medium	Technical	6 Months		

26	Consider the use of 'free cooling ' to supplement chilling	Improved efficiency	Medium	Technical	6 Months		
27	Carry out a major lighting review on site: Example areas cited below	Reduced Costs	Medium	Technical	6 Months		
28	Link Corridor Lamps	1.7k Euro	Medium	Technical	6 Months	Based on a 50 % saving using daylight and occupancy sensing	
29	Plant Room Lighting	2.0 k Euro	Medium	Technical	6 Months	Based on a 50 % saving using occupancy sensing	
30	Water Purification Room	0.36 K Euro	Medium	Technical	6 Months	Based on 90% saving from occupancy sensing	
31	Review all unoccupied areas for potential to use occupancy sensing for lighting control	TBC	Medium	Technical	6 Months		
32	Consider shutdown of lines at night	Reduced Energy Use	No / Low	Organisational	3 Months		
33	Consider separating clean room AHU from Packaging Area	Reduced Energy Use	Medium	Technical	6 Months		
34	Minimise the area requiring humidity control	Reduced Energy Use	Medium	Technical	6 Months		
35	Replace TRVs in Link Corridor Heating with controller	Reduced Energy Use	Medium	Technical	6 Months		
36	Fit Jacket Insulation to steam traps	Reduced Energy Use	Medium	Technical	3 Months		
37	Fit Jacket Insulation to all hot water pumps & valves	Reduced Energy Use	Medium	Technical	3 Months		
38	Repair insulation on Coating Pan Air Handling Room	Reduced Energy Use	No / Low	Technical	3 Months		
39	Repair Leak in AHU 201 Heater	Reduced Energy Use	No / Low	Technical	3 Months		
40	Repair Leak in DCU 301	Reduced Energy Use	No / Low	Technical	3 Months		

41	Carry out an Air Leak Survey	Reduced Compressed Air Losses	No / Low	Technical	3 Months		
42	Consider purchase of an air leak detector	Reduced Compressed Air Losses	No / Low	Technical	3 Months		
43	Review all production plant to determine if it can be shutdown during hours of no production	Reduced Energy Use	No / Low	Organisational	3 Months	Examples include Dust Collectors DCU301,202 , 501	
44	Review Operation of Air Compressors	Reduced Compressed Air Cost	No / Low	Technical	6 Months	Check if Kaiser unit has a VSD	
45	Set up systemto read all main board and sub board meters	Improved Monitoring and Targeting	No / Low	Organisational	3 Months	e.g. LV5,LV6,LV7	
46	Repair/Replace two meters on Chillers	Improved Monitoring and Targeting	No / Low	Technical	3 Months		
47	Check operation of Heating System Weather Compensator	Reduced Heating costs	No / Low	Technical	6 Months		
48	Review operation of Chillers	Reduced Cooling Costs	No / Low	Technical	6 Months		
49	Decommission Filter BO2M Boiler	Reduced Operating Costs	No / Low	Technical	3 Months		
50	Rationalise Dehumidifiers	Reduced Operating Costs	No / Low	Technical	3 Months	5 units reduced to 1 with 1 standby.	

5 Additional Information

The most significant savings to be made on the electrical side are likely to come from:

- Review of the operation of production equipment and its shutdown when not in productive use
- Review of the operation of the chiller systems with a view to their optimisation and the potential use of 'free cooling'
- Review of lighting across the site to determine if new technologies can be used to reduce the cost substantially.
- Review of the operation of the compressed air system to identify and eliminate leaks

There are a number of sub meters that are not operating or not being read across the site. These should be returned to service and regular readings taken to improve the detailed knowledge of the energy flows in the facility. The site should also consider the purchase of a three phase energy analyser to determine the energy consumption patterns of its significant energy users.

In the case of thermal energy the following areas will present the best opportunities

- Improved valve and pipe insulation
- Improved duct insulation
- Eliminate of leaks
- Determine if the control system for the space heating is optimised. (The strong correlation with weather conditions suggested by the analysis may mask the fact that the space heating itself may not be very efficient, e.g. too hot or too cold in certain areas.)
- Assess the design and operation of the clean room areas to determine the precise need for clean rooms for the process operations and rationalise the design to match these requirements.

The most significant other action would be to implement an energy awareness programme for all staff. This would ensure that everyone on site is focussed to reduce the energy they control.

From our experience of similar plants it is likely that there is potential to reduce the energy consumed across the site by 5 to 10 % with the possibility of more if significant capital is deployed. The initial efforts should be focussed on securing the savings that do not require capital before considering those that require significant spending.

6 Next Steps

- Conor Campion should review this report and in particular the opportunities for energy savings identified in Table 4.
- Liam Tolton will contact Conor in about one week to briefly discuss this report and to provide any relevant clarifications.
- SEI has appointed Liam Tolton to provide follow-up energy management mentoring to Rottapharm over the **next three months**. Liam will contact Conor regularly over this period to assist, mentor and encourage Rottapharm in progressing the opportunities for energy savings identified in Table 4 and in improving energy management.
- Rottapharm should use this three month period to kick-start progress on the energy savings opportunities and to improve on the priority areas identified in the Energy Management Diagnostic Questionnaire.
- Conor should contact Liam by email or by telephone over this period with any queries relevant to energy management.
- Ms. Mairead Cirillo of SEI will contact Conor over the next few weeks with a request to fill out a short evaluation of SEI's Services for Business Programme; we would be grateful for co-operation in completing this.
- Ms. Mairead Cirillo of SEI will be in contact shortly to discuss training opportunities provided by SEI that would be of benefit to Rottapharm (ref Opportunity No. 12 in Table 4).

Appendix A – Site Tour Checklist

Item	Score						Observations / Comments
	Poor					Excellent	
	1	2	3	4	5	N/A	
Physical Condition of Buildings / Plant	☐	☐	☐	☒	☐	☐	Generally good
Insulation	☐	☐	☐	☒	☐	☐	Generally good with some valve jackets missing
Steam / Condensate / Hot Water Leaks	☐	☐	☐	☒	☐	☐	Generally good
Boiler House	☐	☐	☐	☒	☐	☐	
Compressed Air	☐	☐	☒	☐	☐	☐	Leak testing required
Cooling Systems	☐	☐	☐	☒	☐	☐	
Production Plant	☐	☐	☐	☒	☐	☐	Generally good
Lighting	☐	☐	☒	☐	☐	☐	Potential for improved controls
Evidence of Energy Awareness (posters etc.)	☒	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐	☐	☐	

Services for Business Programme

- Site Visit Report

Energy Management Diagnostic Questionnaire

Site Name:	Rottapharm Ltd.	**SEI Client ID:**	1234
Participants:	Conor Campion - Project Engineer Paul Ludorf - Project Manager Margaret Healy Safety Officer Mike Lacey Engineering Manager Ger Sweeney Warehouse Dave Dunne Production Ciaran O'Callaghan Facilities	**Score:**	30%
SEI Energy Advisor:	Liam Tolton	**Date:**	26-Feb-09

	Question	Assessment				Additional Comments
Commitment	1 Is there a Co-ordinator appointed to manage Energy Management?	○ No	○ Informal Appointment	◉ Formal Appointment but Low Priority	○ Formal Appointment	Conor Campion
	2 Is there a Senior Manager appointed to sponsor an Energy Management?	○ No	◉ Informal Appointment	○ Formal Appointment but Low Priority	○ Formal Appointment	Mike Lacey
	3 Is there an Energy Policy?	◉ No Policy	○ Informal Policy	○ Incomplete Policy	○ Complete Formal Policy	
	4 Is the Energy Policy communicated to employees?	◉ No	○ Informally	○ Formally but Infrequently	○ Formally & Regularly	
	5 Is there an annual review by senior management of energy performance & Energy Management?	○ No (None)	◉ Superficial Review Only	○ Incomplete Review	○ Formal Documented Review	Financial Review
Identification	6 Have you undertaken an overview of past & present energy consumption?	○ Not at all	○ Informally (No Quantification)	◉ Informally (Some Quantification)	○ Yes (Quantified Assessment)	Based on a 3 day audit that became a CHP feasibility
	7 Have you surveyed current energy use & identified significant energy users?	○ Not at all	○ Informally (No Quantification)	◉ Informally (Some Quantification)	○ Yes (Quantified Assessment)	Based on limited metering information
	8 Have you identified the key factors that influence energy consumption at the site?	○ Not at all	◉ Informally (No Quantification)	○ Informally (Some Quantification)	○ Yes (Quantified Assessment)	May not be production related
	9 Do you continuously identify energy-saving opportunities?	○ Rarely / Never	○ Informally & Infrequently	◉ Informally but Regularly	○ Formally & Regularly	
Plan	10 Do you set (Energy) Objectives & Targets?	○ No	◉ Informally		○ Formally	Based on a financial target
	11 Is there an Energy Savings Programme in place?	○ No (None)	○ Informal Unwritten Programme	◉ Informal Written Programme	○ Formal Programme	Initial list of ideas generated
	12 Are adequate resources allocated to Energy Management / energy saving activities?	○ None Allocated	○ Insufficient (Allocated Informally)	○ Insufficient (Allocated Formally)	○ Full & Sufficient Resources Allocated	Energy Team Estabilised
Action	13 Are energy-efficient practices and energy awareness promoted amongst employees?	◉ Not at All	○ Informally & Infrequently	○ Informally but Regularly	○ Formal Programme	
	14 Are key personnel trained in energy efficient practices?	○ Not at All	○ Informally	◉ Yes (Not All Key Personnel)	○ Yes (All Key Personnel)	
	15 Is there an Energy Savings Register (of Energy saving projects)?	○ No (None)	○ Informal Unwritten List	◉ Incomplete Formal Register	○ Up-to-date Formal Register	
	16 Are energy intensive plant & systems designed, operated & maintained to optimise energy efficiency?	○ Not at all	◉ Efficiency Considered but not Priority	○ Informally (ad hoc)	○ Yes (Formal Procedures in Place)	
Review	17 Have Energy Performance Indicators (EPI) been developed for the site? Are they monitored?	◉ No EPIs	○ Informal EPIs	○ Formal EPIs (Not Monitored)	○ Formal EPIs (Regularly Monitored)	
	18 Is there an Energy Measurement & Monitoring system in place?	○ No (None)	○ Informal System	◉ Incomplete System	○ Formal System	Tends to be project related e.g. Compressor
	19 Is energy performance reported to management and key staff regularly?	○ Not at all	◉ Informally	○ Formally but Infrequently	○ Formally & Regularly	Financial Only
	20 Is the effectiveness of the programme reviewed annually?	○ Not at all	◉ Informally		○ Formal Documented Review	Financial Only

Barriers

What do you consider to be the 3 most important barriers to developing, implementing and maintaining a full and effective Energy Management System within your organisation? [e.g. resources, training budgets, capital budgets, management time, lack of competent personnel etc.]

i	Resources
ii	Lack of information to manage energy
iii	Major Expansion underway