REduced energy consumption in plastics engineering

review of energy management practices, best practice & trends within the plastics processing industry across the world

‘An overview of available energy best practice guidelines, case studies, technologies and organisations, from across the world, relating to the plastics processing industry’

30th September 2005

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EXECUTIVE SUMMARY

RECIPE (Reduced Energy Consumption in Plastics Engineering) is a European funded project to provide plastics processors with the knowledge, justification and tools needed to reduce energy consumption through the implementation of best practice and the introduction of new technologies.

The RECIPE consortium conducted a survey of information related to best practice guidance and energy efficiency in the plastics processing industry. This report aims to draw together the national guidelines available to establish what constitutes best practice for the industry. Information has been compiled from European and non-European countries.

In total, forty-two documents were sourced and they can be divided into the following categories:

- 40% are best practice guidelines specifically aimed at the plastics industry.
- 7% are case studies illustrating examples of best practice in the plastics industry.
- 5% are case studies illustrating examples of best practice within the manufacturing sector.
- 31% are best practice guidelines relating to energy efficiency in any industry.
- 10% are national energy strategies.
- 7% are technical guides for the plastic industry.

The survey was carried out between March and September 2005 and includes:

- An overview of the energy management practices within each country mentioned in the report.
- Organisations within each country that supply guidance relating to energy efficiency.
- A review of each of the documents available.
- Details of where to access the documents reviewed.
- Other sources of information.
- Countries surveyed include, Spain, Germany, Canada, United States, United Kingdom, Denmark and New Zealand.
BACKGROUND

Introduction

RECIPE (Reduced Energy Consumption in Plastics Engineering) is a European Union funded project to provide plastics processors with the knowledge, justification and tools needed to reduce energy consumption through the implementation of best practice and the introduction of new technologies. This industry comprises more than 27,000 companies (more than 80% SMEs) employing more than one million people, and with total sales of over 100 billion euros.

Potential Impacts

In 2001, 35.6 million tonnes of plastic were consumed in the EU, rising to approximately 40 million tonnes when the key Eastern European processing countries are included. Based on UK industry figures for energy usage in each of the major processing technologies (extrusion, blown film, injection moulding and blow moulding) and share of the total processing capacity, we can estimate an average energy use of 1.85 kWh/kg for plastics processing. With a consumption figure of 40 million tonnes, the total figure for energy usage is 74 x 10^9 kWh. This equates to a total annual emission of more than 30 million tonnes of CO2.

If it were possible to reduce energy consumption across the industry by 10%, this would result in an annual reduction in CO2 emissions of more than 3 million tonnes.

RECIPE Partners

RECIPE has 8 partner organisations from 6 countries.

- Rapra Technology Ltd (UK)
  Europe’s leading independent plastics and rubber research and technology organisation providing specialist technical, commercial and information services for the polymer industry and end-user industries including the automotive, construction, electrical, medical, offshore, packaging and polyurethane sectors.

- British Plastics Federation (UK)
  The BPF is the leading trade association for the UK plastics industry (representing approximately 80% of turnover), a springboard for industry action, existing to exploit common opportunities and resolve shared problems. Membership encompasses producers, suppliers and processors in addition to additive and machinery suppliers and manufacturers.

- Danish Technology Institute (Denmark)
  The Danish Technology Institute is a not for profit organisation that promotes growth by improving interaction and encouraging synergy between research organisations, businesses and the community.

- ASCAMM+ (Spain)
  ASCAMM+ is a not for profit organisation founded in 1979. It currently has over 200 members comprising of a workforce of over 4000 people. ASCAMM+’s activities include specialised training, promotion of the industry and advisory services.

- AIMPLAS (Spain)
AIMPLAS is an innovation and technology centre based in Spain. Founded in 1990, AIMPLAS conducts research within the plastics transformation sector in order to increase the competitiveness of the plastics industry and related sectors.

- Pôle Européen de Plasturgie (France)
Pôle Européen de Plasturgie was founded in 1990 with the assistance of the plastics industry: transformers, mould and die manufacturers, machine manufacturers, plastic producers and toolmakers. It aims to increases the competitiveness of the industry by improving the research and technology developments, from design to finished product.

- CRIF – Wallonie (Belgium)
CRIF-Wallonie started life in 1969 as CRIF Plastics; in order to answer the specific needs of the plastic processing members of Agoria. The main activities can be split into three areas; engineering of materials including the design of high tech components in plastic and metal, smart manufacturing and process and rapid manufacturing.

- Fraunhofer Institut fuer Chemische Technologie ICT (Germany)
The research and design expertise of the Fraunhofer Institute for Chemical Technology ICT is primarily geared towards products and processes in the fields of polymer engineering, environmental engineering, electrochemistry and energetic materials.

**Why RECIPE?**
The foundations of RECIPE were developed from the recommendations of the Technology Roadmap (TRM) for Low Energy Polymer Processing conducted by the Faraday Plastics Partnership, (a UK organisation with the aim of improving the competitiveness of the UK plastics industry through research, development, transfer and exploitation of new and improved science and technology). Technology Road Mapping is a high level tool for supporting technology management and planning which has been widely adopted in industry to support national and sector ‘foresight’ initiatives. In its most basic form, a TRM can be considered as a time-based chart consisting of a number of layers that can typically include commercial, technological, legislative and environmental perspectives.

The recommendations of the TRM aim to catalyse the plastics industry into measuring its energy use performance and change for the better. This includes industry benchmarking and sectoral targets – a programme of market research to study how energy efficient the polymer processing sector is in its current practices; a demonstration unit – establishing a ‘show and tell unit’ to illustrate the benefits of energy efficiency, a cost of ownership model – establishing a financial model for typical paybacks to incentivise the industry to adopt energy saving measures and training – in energy measurement and management.

**RECIPE Activities**
The four key activities are:

- **European Best Practice Guide**
  An industry specific guide providing advice related to the processes and working practices prevalent in the industry.

- **Publications**
RECIPE will issue a series of fact sheets relating to energy saving technologies, initiatives and practices and a regular newsletter.

- **Interactive Energy Efficiency Tools**
  The interactive toolkit will enable companies to evaluate energy consumption and look closely at individual processes within the plant. It will then provide guidance on efficiency and highlight key plant areas where they most substantial energy and cost savings can be made most easily. The Cosy of Ownership model, included in the toolkit, will enable processors to calculate the cost of purchasing and operating a piece of equipment over its projected lifetime, based on energy efficiency and projected usage.

- **Information**
  Seminars will be run across Europe demonstrating the latest developments in technology, local energy schemes, funding opportunities and the interactive tools developed by RECIPE.

RECIPE has also conducted a survey of plastics processors across Europe in order to establish where variations exist from ‘typical’ usage and understand how companies view and manage their energy. This is available for download from [www.eurecipe.com](http://www.eurecipe.com).

*Intelligent Energy - Europe*

Intelligent Energy – Europe (EIE) is a European Community programme promoting energy efficiency and renewable sources. The programme aims to encourage the development, demonstration and take-up of energy efficient products, services and renewable energy sources.
ASIA

Overview
There are very few guidelines readily available in Asia, however, in some areas energy efficiency and conservation is becoming an important issue. The Energy Resources Section, Environment and Sustainable Development Division of Economic and Social Commission for the Asia and Pacific (ESCAP), concluded that energy benchmarking should be used in all energy intensive enterprises on the basis of best practice and a system of energy auditing should be established in order to identify current patterns of energy usage and to point out areas of potential savings.

Available Guidelines

- Eco Efficiency for Chemicals and Plastics Industry, (Asia Pacific Economic Co-operation, 1997)
  A guide introducing eco-efficiency practices for the plastics and chemical industries. It is aimed at SME’s and provides practical guidance for identifying and evaluating opportunities for eco-efficiency in the workplace.

- Indian Petrochemicals Corporation Ltd Case Study, (Energy Manager Training)
  A case study illustrating the successful implementation of energy efficiency measures within the polymer industry.

  A case study illustrating how variable speed drives can help reduce energy consumption.

Organisations

- Asia Pacific Economic Cooperation
  Website  [www.apec.org](http://www.apec.org)

- Bangladesh Plastic Goods Manufacturers and Exporters
  Website  [www.bangladeshplastic.org](http://www.bangladeshplastic.org)

- Bureau of Energy Efficiency, India
  Website  [www.bee-india.nic.in](http://www.bee-india.nic.in)

- China Plastics Processing Industry Association
  Website  [www.cppia.com.cn](http://www.cppia.com.cn)

- Energy Manager Training, Indo German Energy Programme
  Website  [www.energymanagertraining.com](http://www.energymanagertraining.com)

- Indian NGOs.com
  Website  [www.indianganos.com](http://www.indianganos.com)

- Indian Plastics Institute
  Website  [www.inplasin.org](http://www.inplasin.org)

- Japan Centre for Climate Change Actions
Website www.jcaca.org

- Japan Environment Association
  Website www.jeas.or.jp

- Japan Environment Management Association for Industry
  Website www.jemai.or.jp

- Malaysian Plastics Manufacturers Association
  Website www.mpma.org.my

- Ministry for Environment, Japan
  Website www.env.go.jp

- Shanghai Energy Conservation Supervision Centre
  Website www.cn-greenlights.gov.cn

- Singapore Plastic Industry Association
  Website www.spia.org.sg

- The Federation of Thai Industries – Plastic Industry Club
  Website www.ftiplastic.com

- The Indonesian Olefin and Plastic Industry Association
  Website www.inaplas.net

- Vietnam Saigon Plastics Association
  Website www.vnplas.com
CANADA

Overview
There are many Canadian organisations playing a dynamic role in helping Canadians save millions of dollars in energy costs while addressing the challenges of climate change. All of the organisations provide users of their website a comprehensive publications and downloads section providing information on everything you need to save energy, save money and help protect the environment while reducing greenhouse gas emissions that contribute to climate change. They also illustrate, through the many programmes available for the residential, commercial, industrial and transportation sectors, up-to-date information on energy efficiency, alternative energy and clean fuels.

Established in 1998 as part of Natural Resources Canada, the Office of Energy Efficiency’s (OEE) mandate is to renew, strengthen and expand Canada’s commitment to energy efficiency. The OEE began with Canada’s commitment to reduce greenhouse gas emissions by 6% below 1990 levels by the period between 2008 and 2012, as agreed in the Kyoto Protocol. Similarly, the Canadian Industry Program for Energy Conservation (CIPEC) is a unique partnership between industry and government that works to improve the energy efficiency of each of Canada’s industrial sectors. Other organisations include the Environment and Plastics Industry Council and Ontario Power Authority.

Available Guidelines

- **Energy Ideas, (Natural Resources Canada, 2004)**
  This is the annual report from the Canadian Industry Program for Energy Conservation (CIPCE). It provides an overview of the energy management accomplishments of the participating sectors and organisations.

- **Energy Management Information Systems, (Natural Resources Canada, 2003)**
  A handbook, designed for all levels of management and operational staff, providing a structured and practical understanding of an Energy Management Information System.

- **Saving Money through Energy Efficiency, (Natural Resources Canada, 2004)**
  This guide provides a step-by-step approach to designing and implementing an effective energy efficiency awareness programme.

Organisations

- **Advanced Design and Manufacturing Institute (ADMI)**
  Website [http://www.admicanada.com](http://www.admicanada.com)

- **Canadian Industry Program for Energy Conservation (CIPEC)**

- **Environment and Plastics Industry Council**
  Website [www.cpi.ca](http://www.cpi.ca)
• **Materials and Manufacturing Ontario**  
  Website [www.mmo.on.ca](http://www.mmo.on.ca)

• **Ontario Power Authority**  
  Website [www.powerauthority.on.ca](http://www.powerauthority.on.ca)

• **The Office of Energy Efficiency**  
DENMARK

Overview
Denmark promotes energy efficiency, renewables and combined heat and power production (CHP). It has set itself several targets including producing 20% of its electricity from renewables and reducing greenhouse gas emissions by 21% in the first budget period 2008-2012 compared to 1990. There is also a stringent national commitment to reduce CO₂ emissions by 20% by 2005, compared to 1988.

Available Guidelines
- **Rationel Energianvendelse i Plastindustrien** *(Dansk Industri, Energi Radgivning Fyn, Plastindustrien, 1998)*
  A guide demonstrating the rational energy usage in the plastic industry
- **Demonstrationsprojekter** *(Dansk Industri, Energistyrelsen, 2002)*
  Demonstration projects

Organisations
- **Aarhus Save Agency**
  Website [www.veo.dk](http://www.veo.dk)
- **Association of Energy and Environment (SEK)**
  Website [www.sek.dk](http://www.sek.dk)
- **Danish Energy Authority**
  Website [www.ens.dk](http://www.ens.dk)
- **Danish Plastics Federation**
  Website [www.plast.dk](http://www.plast.dk)
- **Energy Centre Denmark**
  Website [www.ecd.dk](http://www.ecd.dk)
- **Green City Denmark A/S**
  Website [www.greencity.dk](http://www.greencity.dk)
- **The Danish Organisation for Renewable Energy**
  Website [www.orgve.dk](http://www.orgve.dk)
GERMANY

Overview

There are no best practice guides or publications, specific to energy efficiency and plastics processing, available in Germany. However, there is information available regarding environmental protection as a result of national and feasibility studies, (Example: Gosner 2000).

Available Guidelines

- The Bavarian Environmental Protection Agency published a guide focusing on CO₂ decreasing potential in the plastics processing industry, (BayLfU, 2002).
- The University for Applied Science, Ansbach, Germany carried out a feasibility study on small and medium enterprises (Kirchhöfer, 2001).
- Haag (2005) provide further details regarding injection moulding and material management using software simulation tools.

References

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Umweltschutz in der Kunststoffverarbeitung – Kunststoffverarbeitung, Broschüre der
Senatsverwaltung für Stadtentwicklung, Vorhaben 20594/1 UFP V, ARGUS e.V., Berlin

Kirchhöfer 2001  Kirchhöfer, Hermann
CO₂-Einsparung durch rationelles Energiemanagement in klein- und mittelständischen
Unternehmen der kunststoffverarbeitenden Industrie Mittelfrankens, Pilotstudie,
Fachhochschule Ansbach, 2001

Trautmann 2002  Trautmann, Andreas; Meyer, Jörg; Herpetz Stefan;
Rationelle Energiennutzung in der Kunststoff verarbeitenden Industrie, Vieweg Verlag,

BayLfU 2002  Bayrisches Landesamt für Umweltschutz
CO₂-Minderungspotenziale durch rationale Energiennutzung in de
Kunststoffverarbeitenden Industrie, Augsburg 2002

Haag 2005  Haag, Günter; Binder, Jan; Liedl, Philipp
Rationelle Energieeinsparung und Minimierung des Materialeinsatzes beim Spritzgießen
(REMIS) – Teilvorhaben: Modellierung und statistische Analyse, Steinbeis-
Transferzentrum Angewandte Systemanalyse, Stuttgart 2005

Trade publications also provide technical proceedings with a focus on processing techniques including the energy saving aspects.
Articles relating to energy saving in plastic processing – Kunststoffe Magazine

• Wortberg, Johannes; Kamps, Thomas; Schiffers, Reinhard: Energieaufnahme: Welche Energie kostet ein Antrieb?
  Erschienen in Kunststoffe 03/2003, Seiten: 64-70

• Wortberg, Johannes; Schroer, Thorsten: Materialversorgung: Mehr Effizienz beim Trocknen
  Erschienen in Kunststoffe 10/2003, Seiten: 149-154

• Kleinebrahm, Michael: Nur die Wirtschaftlichkeit zählt
  Antriebskonzepte für Spritzgießmaschinen

• Liebig, Gerd: Nur der Nutzen zählt
  Leistungsvergleich zweier hybrider und vollelektrischer Maschinen

• Kraibühler, Herbert: Modulare Antriebssysteme im Fokus
  Arburgs Technologie-Tage mit neuen Technik-Highlights
  Erschienen in Kunststoffe 05/2002, Seiten: 64-66

• Henkel, Isabelle; Becker, Jens: Energie-Contracting: Energieeffizienz senkt Betriebskosten
  Erschienen in Kunststoffe 05/2003, Seiten: 26-27

• Thielen, Michael: Blasformen: Mehr als nur heiße Luft
  Erschienen in Kunststoffe 12/2004, Seiten: 64-66

• Wortberg, Johannes; Kamps, Thomas: Kosten und Leistung: Antriebstechnik im Vergleich
  Erschienen in Kunststoffe 10/2003, Seiten: 70-75

• Wortberg, Johannes; Kamps, Thomas; Schiffers, Reinhard: Antriebstechnik im Vergleich
  Spritzgießmaschinen mit unterschiedlichen Antriebsarten im Praxisvergleich

• Fischer, Jürgen: Schäumbares Polystrol (EPS)
Erschienen in Kunststoffe 10/2001, Seiten: 270-274

- Hörl, Thomas; Betsche, Markus:
  Modularität: Multitalent für wirtschaftliche Spritzgießfertigung
  Erschienen in Kunststoffe 02/2005, Seiten: 54-58

- Michaeli, Walter; Bölinger, Simone; Kudlik, Nikolaus:
  Die richtige Maschine, aber welche?
  Ein Kennzahlensystem hilft bei der Spritzgießmaschinenauswahl
  Erschienen in Kunststoffe 05/1999, Seiten: 50-52

- Liebig, Gerd; Mehler, Christoph:
  Kostenbewusstsein: Moderne Technologie ist wirtschaftlicher als Low-spec

- Thielen, Michael:
  Blasformen: Formen mit Luft
  Erschienen in Kunststoffe 09/2004, Seiten: 118-122

- Kotzab, Werner:
  Der Impuls zum Energie sparen
  Ein neues System zur Werkzeugtemperierung
  Erschienen in Kunststoffe 05/2001, Seiten: 74-77

- Schneider, Hans-Peter:
  Wirtschaftlichkeit und Qualität gesteigert
  Trends in der PVC-Profil- und Rohreextrusion

**Articles relating to energy saving in plastic processing – FIZ Technik**

- Michaeli, W.; Schmitz, T.
  Lohnender Vergleich. Extrusion von PET-Folien mit Entgasung, Inst f Kunststoffverarbeitung (IKV), RWTH
  Aachen, DE, Zeitschriftenaufsatz: Plastverarbeiter / 2004 / 200410 03977

- Lewan, M.; Campion, R.; Iddon, M.
  Of the NFM Iddon cold feed extruder and novel low temperature curing EPDM to reduce processing and
curing energy consumption, Konferenz-Einzelbericht: Engineering Elastomers, 1 / 2003 / 200404 02611

- Kuhn, G.; Jacoby, T.
  Technische Möglichkeiten zur Dampfeinsparung in der EPS-Formteilherstellung. Erlenbach, Lautert, DE
  Technological possibilities for saving steam in the EPS moulding. Konferenz-Einzelbericht: Schriftenreihe
  Kunststofftechnik (VDI) / 2003 / 200401 05839
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  Kühle Behandlung. Kälteanlagen für den kunststoffverarbeitenden Betrieb, Zeitschriftenaufsatz:
  Plastverarbeiter / 2003 / 200307 09039

• Zlotos, M.
  Trocknen mit Trockenluft: Wirtschaftlich und energiesparend. Technische und betriebswirtschaftliche
  Betrachtung der Trockenlufttrocknung, Mann+Hummel ProTec, Ludwigsburg, DE, Zeitschriftenaufsatz:
  Kunststoffberater / 2002 / 200209 05847

• Miethlinger, J.; Mayr, A.
  Teppiche beschichten. Geringerer Energieverbrauch und bessere Rezyklierbarkeit SML Maschinenges,
  Lenzing, AT, Zeitschriftenaufsatz: Kunststoffe, München / 2001 / 200105 00683

• Neubert, T.; Helbig, A.; Helduser, S.
  Regelbare Pumpenantriebe verbessern Spritzgießmaschinen TU Dresden, DE, Zeitschriftenaufsatz: MM -
  Maschinenmarkt, Würzburg / 2000 / 200011 05614

• Kleinebrahm, M;
  Nur die Wirtschaftlichkeit zählt. Antriebskonzepte für Spritzgießmaschinen, Boy, Neustadt/Wied, DE
  Zeitschriftenaufsatz: Kunststoffe, München / 1999 / 200001 01143

• Schreiber, M.; Meyer, J.; Starke, M.; Haug, M.; Wittmer, A.
  Verringerung des Wärmeenergieeinsatzes in einem Unternehmen der kunststoffverarbeitenden Industrie
  mittels dynamischer Simulation unter besonderer Berücksichtigung productionstechnischer Belange,
  Konferenz-Einzelbericht: VDI-Berichte / 1999 / M9907 1041 561

• Hoffmanns, W.
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  DE, Zeitschriftenaufsatz: Maschinenmarkt, Würzburg / 1999 / M9902 1216 533 Wortberg-J; Michels-R;
  Neumann-M / Univ -GH Essen, DE

• Elektromechanisch angetriebene Blasformmaschinen - Eine Vision?
  Konferenz-Einzelbericht: Kunststofftechnik / 1997 / M9710 0253 563

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  Energiemanagement. Kosten senken im Spritzgießbetrieb; Ges Wärme Kältetech, Kierspe, DE,
  Zeitschriftenaufsatz: Kunststoffe, München / 1997 / M9702 0720 603
NEW ZEALAND

Overview
In March 2005, the New Zealand Cabinet confirmed a policy to assist energy-intensive businesses (EIBs) to reduce greenhouse gas emissions and to alleviate the possible adverse effects of the new carbon tax (to be introduced in 2007) through improved energy efficiency. A pilot scheme was introduced in 2005 to test the effectiveness of the grant scheme and demonstration projects, which included the plastics industry.

The Energy Efficiency and Conservation Authority and the Climate Change Group in the Ministry for the Environment, in consultation with industry associations, select technologies that are capable of delivering significant energy savings. These technologies are then demonstrated in the pilot scheme and the case studies disseminated through the EECA website and trade associations.

Available Guidelines

  The purpose of the strategy is to promote energy efficiency, energy conservation and renewable energy within the context of a sustainable energy future.

  A technical guide detailing how to reduce motor drive energy costs

- **The Plastics Sustainability Initiative, (Plastics New Zealand, 2004)**
  The New Zealand Plastics Sustainability Initiative is a five-year agenda for action launched in 2003 to minimise the effect of the industry and its products on the environment.

- **Energy Case Studies, (Business Care New Zealand)**
  Case studies illustrating how to use resources such as water, energy and raw materials efficiently.

Organisations

- **Business Care**
  Website [www.businesscare.org.nz](http://www.businesscare.org.nz)

- **Energy Efficiency and Conservation Authority (EECA)**
  Website [www.eeca.govt.nz](http://www.eeca.govt.nz)

- **Energy Information New Zealand**
  Website [www.energyinfonz.com](http://www.energyinfonz.com)

- **Energy Library and Information Services**
  Website [www.energylibrary.co.nz](http://www.energylibrary.co.nz)

- **Energy Management Association of New Zealand**
  Website [www.ema.org.nz](http://www.ema.org.nz)

- **New Zealand Climate Change Office**
Website  www.climatechange.govt.nz

- Plastics New Zealand -
Website  www.plastics.org.nz
Overview

There are several organisations within Spain promoting the efficient use of energy in the country. For example, the Institute for Energy Diversification and Saving (IDAE) promotes energy efficiency and the rational use of energy, supports the diversification of sources of supply and promotes the use of renewable sources of energy. The Institute carries out dissemination, awareness-raising and advisory services for all energy consuming sectors.

Available Guidelines

- Plan de Ahorro y Eficiencia Energética de la Comunidad Valenciana, Sector Industrial, Período 2001-2010, AVEN. Generalitat Valenciana
  Energy Saving and Efficiency Programme in the Valencian Community (Spain), Industrial Sector, Period 2001-2010. Valencian Energy Agency (AVEN), Generalitat Valenciana (Regional Government)

- Plan de Ahorro y Eficiencia Energética en Andalucía, 2004-2006, Junta de Andalucía, Industria del Plastico
  Energy Saving and Efficiency Programme in Andalucía (Southern Spain), Period 2004-2006, Plastic Industry

  This publication analyses the use of energy in companies displaying several measures aiming to save money. Sections included are: lighting, heating, water, boilers, electrical equipment, compressed air, vehicles, fuel purchase and business management.

  Following the introduction of the Basque Environmental Strategy for Sustainable Development 2002-2020, this is the first document on energy and environment indicators in the Basque Autonomous Community.

Organisations

- Agencia Valenciana de la Energía (AVEN)
  Website [www.aven.es](http://www.aven.es)

- IHOBE
  Website [www.ihobe.es](http://www.ihobe.es)

- Institute for Energy Diversification and Saving (IDAE)
  Website [www.idae.es](http://www.idae.es)
UNITED KINGDOM

Overview

UK plastics companies are facing average price increases of 56% for electricity and 58% for gas according to a new 2005 survey carried out by the British Plastics Federation (BPF). Furthermore, national energy consultancy, Energy 2000, have warned that businesses should expect up to a staggering 60% increase in their overheads as a result of a ripple-effect on the supply chain, from this year’s energy price rises alone, (Source: Manufacturing Talk).

There are many organisations promoting energy efficiency in industry, and specifically the plastics industry. For example, the Carbon Trust is an independent company funded by the Government to help the UK move to a low carbon economy. Their aim is to help businesses and the public sector reduce carbon emissions now and capture the commercial opportunities of low carbon technologies. A second organisation, Envirowise, is a Government programme offering free, independent and practical advice to UK businesses to reduce waste at source and increase profits. They both (as well as many other organisations) provide best practice guidelines and case studies through their website on how different sectors (including plastics) can reduce their energy consumption.

Available Guidelines

  A Good Practice Guide (239) providing advice on practical ways of improving energy efficiency in the extrusion of thermoplastics.

  A Good Practice Guide (292) to assist owners and operators of plastics manufacturing facilities to save energy and improve the cost effectiveness of their operations.

  A Good Practice Guide (85) explaining why energy management training is important for both individuals and organisations and outlines the help available for those seeking energy efficiency training.
  [http://www.actionenergy.org.uk](http://www.actionenergy.org.uk)

- **Energy Efficient Tooling for Injection Moulding, (Carbon Trust, 2004)**
  A fact sheet illustrating the project, to develop injection moulding tooling which will reduce the specific energy required in injection moulding.

- **Managing and Motivating Staff to Save Energy, (Department of the Environment, Transport and the Regions, 1993)**

- **Managing and Motivating Staff to Save Energy, (Department of the Environment, Transport and the Regions, 1993)**
A Good Practice Guide (84) to show the important part that people play in managing energy. It emphasises that energy is a management issue and offers guidance on how to start an energy saving campaign, with particular advice on how to motivate staff to save energy.

http://www.thecarbontrust.co.uk/energy/pages/publication_search.asp?PubID=3523&PubPath=%5CPublication+type%5CGood+Practice+Guides#

- **Resource Efficiency, (Enworks)**
  A business guide to making environmental practice profitable.
  http://www.enworks.com

- **The Business Energy Efficiency Programme**
  A guide illustrating why being energy efficient is good for a business. A detailed case study is also provided.
  http://www.britishgasbusiness.co.uk

- **6-step Energy Saving Plan, (ABB Ltd, 2003)**
  A guide to the 6 step plan to energy saving, including energy appraisals, management, savings, energy efficient products and how to make an impact on your energy bill.
  http://www.abb.co.uk/energy

- **Climate Change and your Business, (The Carbon Trust, 2004)**
  An information pack providing advice on saving energy quickly and easily at little or no cost.
  http://www.thecarbontrust.co.uk/energy/pages/page_30.asp

- **Energy and Environment SME Toolkit, (Federation of Small Businesses in Scotland, Scottish Executive, 2003)**
  A guide on how to cut waste, energy, water and transport and comply with environmental legislation. The toolkit is designed to help you cut your business running costs, and ensure you operate within all the regulations that may apply to you.

- **Energy Efficiency, (EEBPP, 2001)**
  The first in a series of energy efficiency worksheets to assist the plastics industry reduce costs through the efficient use of energy.

- **Energy Management at a large Injection Moulding Site, (ETSU, 2000)**
  A Good Practice Case Study (225) demonstrating the energy savings that can be achieved by introducing basic energy management techniques to a large plastics injection moulding site.
  http://www.thecarbontrust.co.uk/energy/pages/publication_search.asp?PubID=3508&PubPath=%5CRubber+%26+Plastics

  The guide aims to clarify some of the common problems that are encountered when using specific energy consumption (SEC) as a performance indicator and presents a simple approach to assessing energy performance that allows meaningful comparisons.
  http://www.thecarbontrust.co.uk

A Good Practice Guide (92) aimed at businesses wanting to reduce the electricity costs incurred in extrusion-blow moulding. The guide describes the ways in which electrical energy is used to make extrusion-blow mouldings of thermoplastics. It shows how much energy is used by a wide variety of companies, suggests where energy savings may be looked for during the process and describes how energy may be managed and saved.

[http://www.thecarbontrust.co.uk/energy/pages/publication_search.asp?PubID=3523&PubPath=%5CPublication+type%5CGood+Practice+Guides](http://www.thecarbontrust.co.uk/energy/pages/publication_search.asp?PubID=3523&PubPath=%5CPublication+type%5CGood+Practice+Guides)


This guide has been designed to help managers bring about improvements in how their organisations manage energy consumption.

[http://www.thecarbontrust.co.uk/energy/pages/publication_search.asp?PubID=3523&PubPath=%5CPublication+type%5CGood+Practice+Guides](http://www.thecarbontrust.co.uk/energy/pages/publication_search.asp?PubID=3523&PubPath=%5CPublication+type%5CGood+Practice+Guides)

• **Reducing Electricity Use in Injection Moulding, (Department of the Environment, Transport and the Regions, 1998)**

A Good Practice Guide (48) describing the ways in which energy is used to make injection mouldings. It shows how much energy is used by a variety of moulding companies, suggests where any savings may be looked for during the process and describes how much energy may be saved and managed.

[http://www.thecarbontrust.co.uk](http://www.thecarbontrust.co.uk)

• **Energy Efficiency in Plastics Processing – Technical Update 1 – All Electric Injection Moulding Machines, (Carbon Trust & Polymer Machinery Manufacturers and Distributors Association)**

A guide illustrating the benefits of electric injection moulding machines.

[http://www.pmmda.org.uk/TU1%20-%20All-electric.PDF](http://www.pmmda.org.uk/TU1%20-%20All-electric.PDF)

• **Resource Efficiency: Cut costs in plastics processing, (Envirowise, 2003)**

This Envirowise Good Practice Guide provides training materials to help plastics processing companies implement a resource efficiency programme.

[http://www.envirowise.gov.uk](http://www.envirowise.gov.uk)

**Organisations**

- **ABB Ltd**
  Website [www.abb.co.uk/energy](http://www.abb.co.uk/energy)

- **British Gas Business**
  Website [www.britishgasbusiness.co.uk](http://www.britishgasbusiness.co.uk)

- **British Plastics Federation**
  Website [www.bpf.co.uk](http://www.bpf.co.uk)

- **Envirowise**
  Website [www.envirowise.gov.uk](http://www.envirowise.gov.uk)

- **Enworks**
Website www.enworks.com

- Polymer Machinery Manufactures & Distributors Association (PMMDA)
  Website www.pmmda.org.uk

- Tangram Technology Ltd
  Website www.tangram.co.uk

- The Carbon Trust
  Website www.thecarbontrust.co.uk
UNITED STATES

Overview
The plastics industry consumes approximately 6% of all the energy used by U.S. industries, and is valued at $6 billion (based on 1998 DOE and other data). The DOE estimates that reducing the plastics industry’s energy use by as little as 1% by 2010 may reduce the total annual energy costs by $100 million. In 2003, the Society of the Plastics Industry Inc. and DOE formed a partnership to identify the potential for plastics manufacturers to reduce their overall energy use, enhance productivity and save money.

Further US organisations promote and analyse technologies, process innovations and policies to increase the energy efficiency and competitiveness of manufacturing industries.

Available Guidelines

  A booklet aimed at manufacturers who want to achieve more strategic control over rising energy costs.

- Energy Accounting: A key tool in managing energy costs, (California Energy Commission, 2000)
  A guide explaining energy accounting, including background information, how to get started and the use of software packages.
  http://www.energy.ca.gov/reports/efficiency_handbooks/

  Fact sheet about how to determine the cost of compressed air.
  http://www.eere.energy.gov/industry/bestpractices/pdfs/compressed_air.pdf

  Fact sheet about how to determine your compressed air requirements
  http://www.nrel.gov/docs/fy04osti/36140.pdf

  Examples of manufacturers that have applied energy and process efficient technologies, cut costs, increased productivity and improved overall competitiveness.
  http://www.eere.energy.gov/industry/bestpractices/pdfs/plantprofiles.pdf

  Guide on how to get management buy in for energy projects.
  http://www.eere.energy.gov/industry/bestpractices/jul2000_guest.html

  A summary report and case studies identifying the potential for plastics manufacturers to reduce their overall energy use, enhance productivity and save money.

  A case study illustrating how the Bemis Manufacturing Company, a compression moulding company, saved more than $22,000 per year by implementing the Industrial energy assessment recommendations.

  A PowerPoint presentation demonstrating how the Industrial Assessment Centre assisted plastic injection moulders to reduce their energy costs.

Organisations

- American Council for an Energy Efficient Economy
  Website www.aceee.org

- California Energy Association
  Website www.energy.ca.gov

- National Associations of Manufacturers
  Website www.nam.org

- Plastic Institute of America
  Website www.plastics institute.org

- Society of Plastics Engineers
  Website www.4spe.org

  Website www.eere.energy.gov
ADDITIONAL INFORMATION

A search was carried out in the following countries for best practice guidelines however there were none readily available. Nevertheless, the following organisations were identified as having significance for the plastics industry.

ARGENTINA

- Plastivida Argentina
  Website www.plastivida.com.ar

AUSTRALIA

- Plastics and Chemical Industries Association
  Website www.pacia.org.au

BELGIUM

- Agoria Plastics
  Website www.agoria.be
- Association of Belgian Manufactures of Reinforced Plastics/Composites
- Association of Plastics and Rubber Converters (Febelplast)
  Website www.fedichem.be
- Federation of Enterprises in Belgium
  Website www.vbo-feb.be
- Flemish Plastics Technology Centre
  Website www.vkc.be
- Plastics and Rubber Manufacturers and Trading Companies (Fedichem Polymers)
  Website www.fedichem.be

BRAZIL

- Plastivida Brazil
  Website www.plastivida.org.br

CHILE

- Chilean Plastics Industries Association
  Website www.asipla.cl

FRANCE

- Syndicat des Producteurs de Matières Plastiques (SPMP)
  Website http://spmp.sgbd.com
- Federation de la Plasturgie
  Website www.laplasturgie.fr
- Association Française des Industries de Moule, Modèle et Maquette
ITALY

• **Italian Association of Plastics Recyclers (ASSORIMAP)**
  Website  www.assorimap.it

• **Italian Plastics and Rubber Processing Machinery and Moulds Manufacturers Association (ASSOCOMAPLAST)**
  Website  www.assocomaplast.org

• **MACPLAS**
  Website  www.macplas.it

• **National Association of Plastics Manufacturers (PLASTICEUROPE ITALIA)**
  Website  www.plastica.it

• **Rubber and Plastics Federation**
  Website  www.federazionegommaplastica.it

• **UNIONPLAST**
  Website  www.unionplast.it

SOUTH AFRICA

• **Plastics Federation of South Africa**
  Website  www.plasticsinfo.co.za
CONCLUSIONS

Countries Surveyed
A total of 25 countries were surveyed from inside and outside of the EU to identify information related to best practice guidance and energy efficiency in the plastics processing industry. Of the countries surveyed only 9 have national guidelines readily available, however, within the remaining countries there are trade and specialist organisations for the plastic and energy industries.

Guidelines Available
In total 42 documents were sourced covering energy efficiency in the plastics industry and general manufacturing.

<table>
<thead>
<tr>
<th>Table 1 - Breakdown of available energy efficiency guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best practice guidelines specifically for the plastics industry</td>
</tr>
<tr>
<td>Case studies specifically aimed at the plastics industry</td>
</tr>
<tr>
<td>General case studies relating to energy efficiency in industry</td>
</tr>
<tr>
<td>General best practice guidelines relating to energy efficiency in industry</td>
</tr>
<tr>
<td>Energy strategies</td>
</tr>
<tr>
<td>Technical guides</td>
</tr>
</tbody>
</table>

This survey has generated enough information to understand what constitutes best practice for the industry. It also provides insights into the attitudes and policies of each of the surveyed countries.

Next Steps
Growth in the European plastics industry is either relatively static or declining as processors face intense competition from lower wage economies as well as increases in the price of energy. RECIPE aims to provide plastics processors with the knowledge, justification and tools needed to reduce energy consumption through the implementation of best practice and the introduction of new technologies. Therefore, the next steps will be: -

1. An industry specific guide promoting the best of the best. The European Best Practice Guide for the plastics processing industry will provide advice related to the processes and working practices. The guide will cover the major processes as well as details on how to get the buy-in of management, encourage and motivate staff to reduce/save energy, purchasing energy and monitoring consumption. This will be available from February 2006.

2. A series of fact sheets will be produced addressing specific design issues related to energy consumption in plastics injection moulding, including the use of software packages, design of pumps and heat exchangers and advances in cooling.
REDUCED ENERGY CONSUMPTION IN PLASTICS ENGINEERING

REVIEW OF ENERGY MANAGEMENT PRACTICES, BEST PRACTICE & TRENDS WITHIN THE PLASTICS PROCESSING INDUSTRY ACROSS THE WORLD

APPENDIX 1 – COUNTRIES SURVEYED
APPENDIX 1

Countries Surveyed

1. Argentina
2. Australia
3. Bangladesh
4. Belgium
5. Brazil
6. Canada
7. Chile
8. China
9. Denmark
10. Germany
11. France
12. India
13. Indonesia
14. Italy
15. Japan
16. Malaysia
17. New Zealand
18. Singapore
19. South Africa
20. Spain
21. Thailand
22. Turkey
23. United Kingdom
24. United States
25. Vietnam