Possibilities of Energy Savings in Extrusion

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Background

> Vienna University of Technology
  - Basis research on Sustainable Product Development, EU-Projects
  - Development of methodologies
  - Education, University eLearning course, etc.
  - Information platform www.ecodesign.at

> ECODESIGN company GmbH – Spin-off
  - Strategy for sustainable product development
  - Product improvement
  - LCA, Product Carbon Footprint
  - Company trainings
  - www.ecodesign-company.com
Projects

- Green Pipe - Development of an energy-efficient cooling method with utilization of the waste heat for pipe extrusion, Partner: Cincinnati Extrusions, Poloplast, Energie2020
- Energy efficiency label - Development of a measuring standard for the energy demand and efficiency criteria for classifying plastics processing machines, Partner: Cincinnati Extrusions, ENGEL, Internorm, Schöfer, Profes, Factory of Tomorrow
- LCA to go - Boosting Life Cycle Assessment Use in European SMEs, funded by European Union 7th Framework Programme under grant agreement n° 265096, www.lca2go.eu
Why? We are facing several forms of crisis…

- Climate Change
  - Global Warming
  - Floodings, etc.
- Resources crises
  - Availability goes down
- Energy crisis
  - Volatile Oil price
  - Old infrastructure
  - Investment 350 Bill.$/a needed
- Nutrition crises
  - Growing energy plants
- …

[Diagram: Global Warming Projections]
Product life cycle:
- injection moulding
- extrusion
- machining
- welding
- casting
- truck
- train
- ship
- airplane
- ... 

Production of:
- polystyrene
- glass
- sheet steel
- aluminium
- ... 

Consumption of:
- paper
- electricity
- detergent
- ... 

Goal: Identifying the significant environmental impacts of a product for further product improvement

Environmental profile-Extrusion

Life cycle phase
- Raw materials
- Manufacturing
- Distribution
- Use
- End of life

Relative environmental impact
- 100%
- 80%
- 60%
- 40%
- 20%
- 0%
- -20%

Life cycle phase

Mixing/ conveying
Extruder
Downstream
Chiller
Energy saving potentials

**Extruder**
- Using efficient AC Drive
- Compensation of reactive current – reduced burden on the wire, less ohmic drop
- Cylinder insolation – less waste heat
- Dimensioning of components to application for efficient use

**Downstream, Cooling,**
- Higher temperature difference of input/return cooling water and lower cooling rate

**Chiller**
- Cooling tower
- Waste heat - Heat pump
Extruder Drive

- AC Drive
- 13-15% higher efficiency
  - Esp. In partial load
- Reduced reactive current 50-80%
- reduced burden on the wire
- No external ventilation needed

Life cycle cost of extruder drive [%]

Efficiency of AC/DC Extruder Drive

AC Drive: 13-15% higher efficiency in main area to apply (50-90%)

Quelle: Motorvergleich Cincinnati Extrusion beim Vollumstieg auf AC Antriebe
**Downstream: whole production line**

- Vacuum tank-and Spray bath
  - Higher temperature difference of in- and return flow
  - Waste heat usage
  - Cooling tower: Natural (free) Cooling, usage of ground water
  - Reduced Chiller demand
  - Reduction of basic demand and useless cooling
  - Reduction of pump demand

**Specific downstream improvement**

**Project: Greenpipe**

Status and approaches:
1.) Compressor demand
2.) Pump energy
3.) Waste heat

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**Improvement**

- Compressor:
  - 80 kW

- Chiller:
  - 10 kW

- Pump energy:
  - 10 kW

- Vacuum tank-and Spray bath:
  - Cooled pipe (50°C)

- Output temperature 20°C
- Input temperature 15°C
Greenpipe: Status cooling line

- Full cooling performance
- Little temperature difference of cooling fluid
- Closed cooling circle
- High chiller and pump demand
- Waste heat not usable, due to low temperature niveau

Greenpipe: Improved cooling line

- Melted plastic
- Waste heat
- Free cooling
- Chiller
**Greenpipe: Resulting energy savings**

- per production line
  - Reduced Mass flow rate - 80%
  - Reduced pump demand
  - Less cooling loses in cycle system
  - Reduced Water conditioning
- Chiller demand - 60%
  - Reduced Energy demand
- Potential for waste heat
  - Return water temperature raised from 20 to 45°C
  - Used for heating production plant - 80% Gas demand saved

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**Project: Energy efficiency Label of Plastic processing machines**

- Goal was a
  - Credible, objective comparison of the energy efficiency
  - Energy efficiency as buying decision
  - Opportunity to market energy-efficient machines
- Project steps
  - Energy measurement standard
  - Energy efficiency criteria
  - Energy efficiency instrument
Energy measurement standard (2008)

<table>
<thead>
<tr>
<th>EUROMAP 60</th>
<th>Determination of specific machine related energy consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw dia. [mm]</td>
<td>Specific energy consumption [Wh/kg]</td>
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Efficiency classes (2013)

- Efficiency class 1
- Efficiency class 2
- Efficiency class 3
- Efficiency class 4
- Efficiency class 5
- Efficiency class 6
- Efficiency class 7
- Efficiency class 8

Figure 4: Efficiency classes for small machines

Reference: www.euromap.org

Label Design Company Engel (2013)
Advantages through ECODESIGN

- Derive new product ideas
- Improve environmental performance (energy efficiency) of own products and communicate it
- Overall improved cost structure

Sustainability of the company

Project: LCA to go

Boosting Life Cycle Assessment Use in European Small and Medium-sized Enterprises

- 18 partners from 9 countries
- Duration: January 1, 2011 – December 31, 2014
- funding from the European Union Seventh Framework Programme (FP7) under grant agreement n° 265096

Goals
- Enhance credibility - robust, reliable, transparent: Methodology
- Develop sector specific tools: sector specific data
- Develop easy to use tools: lower barrier for acceptance
Environmental Assessment of industrial machines

- We offer a free analysis of your industrial machine using the LCA to go webtool which leads
  - with reasonable efforts to reliable Environmental Assessment results
  - to an Environmental Profile without prior knowledge

Available for free: www.lca2go.eu

- Tailored to the industrial machines it offers
  - Sector specific data
  - goal-oriented improvement measures
  - clear indicators

- We support you in applying the tool and to derive improvement measures
Thank you for your attention

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