PVC PRODUCTS COMPETITIVENESS

A total cost of ownership approach

Prof. Alessandro Marangoni

Study presentation Brussels, November 8th 2011
Summary

1. Objectives and description
2. The methodology
3. The products:
   - Window profiles
   - Outdoor pipes
   - Flooring
4. Conclusions
1. Objectives and description

The mission

Which are the costs of using PVC products compared to the most popular alternatives?

The scope

The investigation concerns:
- window profiles
- outdoor pipes
- flooring

The countries

- Germany
- Italy
  (North-South Europe represented)
2. The methodology

**Total Cost of Ownership**

- a “customer centric” analysis
- explains the difference between:
  - the *purchase price* of something
  - and its *long term cost*
- it is useful to *compare different products*

**TCO**

- **Buying**
- **Transport**
- **Install**
- **Use**
- **Maintenance**
- **Dismount**
- **Transport**
- **Discharge**

**Waste disposal**

**Recycle**
3. The products

- Window profiles
- Outdoor pipes
- Flooring
**Window profiles**

**Key issues**

- EU climate package 20-20-20 focus on the energy efficiency and the environmental impacts of products
- In 2010 EU27 countries, buildings are the biggest consumer of energy → a tangible opportunity to save heating consumption
- Windows profiles can play an important role reducing energy losses
- Windows figures: turnover: 8,8 bln € in Germany, 4,8 bln € in Italy
- PVC market share: 57% Germany, 18% Italy

**Energy consumption**

- Buildings 31%
- Transport 30%
- Industry 24%
- Commerce & Services 15%

*Source: Eurostat*
Assumptions

The conceptual framework for windows

- **Capital cost**
  - Price
  - Fiscal incentives
- **Installation costs**
  - Standard installation
- **Use costs**
  - Energy savings
- **Maintenance costs**
  - Ordinary maintenance
  - Painting
- **Dismantling costs**
  - Dismounting and disposal

- The final users are individuals clients
- Functional Unit: 130 x 130 cm (Germany), 123 x 148 cm (Italy)
- All the calculations have been expressed in € per square metre
- The planning period is fixed at 30 years
- VAT (19% in Germany and 20% in Italy) is accounted as non deductible cost
- All data are adjusted to present value (discount rate: 5%; inflation rate: 2%)
## The results

### Discounted cash flows

<table>
<thead>
<tr>
<th>€/sqm</th>
<th>GERMANY</th>
<th>ITALY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PVC</td>
<td>WOOD</td>
</tr>
<tr>
<td>Net market price</td>
<td>-124</td>
<td>-154</td>
</tr>
<tr>
<td>VAT</td>
<td>-24</td>
<td>-29</td>
</tr>
<tr>
<td>Installation cost</td>
<td>-74</td>
<td>-74</td>
</tr>
<tr>
<td>VAT</td>
<td>-14</td>
<td>-14</td>
</tr>
<tr>
<td><strong>Total initial investment</strong></td>
<td>-235</td>
<td>-271</td>
</tr>
<tr>
<td>VAT</td>
<td>-9</td>
<td>-18</td>
</tr>
<tr>
<td>Total maintenance</td>
<td>-56</td>
<td>-112</td>
</tr>
<tr>
<td><strong>Total Cash Outflows</strong></td>
<td>-291</td>
<td>-383</td>
</tr>
<tr>
<td>Total Energy Savings</td>
<td>784</td>
<td>784</td>
</tr>
<tr>
<td><strong>Net Present Value</strong></td>
<td>493</td>
<td>401</td>
</tr>
<tr>
<td>Pay Back Period (years)</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

**Minimum TCO**
Conclusions

Net savings
Net savings are always positive: investing in new windows creates value

PVC windows
PVC has the lowest initial price, the fastest returns, and the higher net present value over 30 years lifecycle

- Spending 1 € in a PVC windows generates on average 2 € back
- PVC is the best investment compared to the alternatives not only for the initial price, but also considering the overall economic performance

Germany
Pay back period:
- for PVC is 8 years;
- for wood and aluminium is 9 and 14

Italy
- Italy has payback periods longer than Germany (warmer climate, higher buying price)
- PVC shows anyway the best economic results with a payback time of 12 years
PVC products competitiveness

- Window profiles
- Outdoor pipes
- Flooring
Outdoor pipes

Key issues

- Germany and Italy: similar infrastructure index for mains; different for sewers

<table>
<thead>
<tr>
<th></th>
<th>MAIN</th>
<th>SEWER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>km</td>
<td>m/per capita</td>
</tr>
<tr>
<td>D</td>
<td>145.000</td>
<td>6,07</td>
</tr>
<tr>
<td>IT</td>
<td>294.000</td>
<td>6,19</td>
</tr>
</tbody>
</table>

- Water networks:
  - In Germany: Iron/cast Iron (more than 55%); plastic (30%), concrete 10%
  - In Italy: steel/iron (60%), plastics (20%); asbestos cement-concrete (16%)

- Planned investments:
  - Germany: 58 €/bln € will be invested by 2020 to repair the sewage system
  - Italy: 20 €/bln; by 2020 30.000 km of mains and 12.000 km of sewerage must be installed
**Assumptions**

- The analysis considers drinking water (pressure pipes) and sewage (gravity pipes) made of different materials
- The final users are the local utilities
- The planning period assumed is 50 years
- All data are adjusted to present value (discount rate: 5%; inflation rate: 2%)

**Break-down by material**

<table>
<thead>
<tr>
<th>Family</th>
<th>Water Mains</th>
<th>Sewerage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastics</td>
<td>PVC</td>
<td>PVC</td>
</tr>
<tr>
<td>Polyethylene (PE)</td>
<td>Corrugated PE</td>
<td></td>
</tr>
<tr>
<td>Ferrous</td>
<td>Ductile Iron</td>
<td>-</td>
</tr>
<tr>
<td>Cements</td>
<td>-</td>
<td>Clay</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>Concrete</td>
</tr>
</tbody>
</table>

**The conceptual framework for pipes**

1. **Buying**
   - Pipe costs
     - List prices
     - Discount
2. **Transport/install**
   - Installation costs
3. **Use costs**
   - Use costs
     - Energy costs
4. **Maintenance costs**
   - Maintenance costs
     - Excavation
     - Temporary re-establishment costs
     - Yard assistance
5. **Dismount costs**
   - Dismount costs
     - Removal old pipe
     - Transport + Dispose
The results
an example: MAINS - ITALY

Present total cost of ownership over 50 years (€/m)

<table>
<thead>
<tr>
<th></th>
<th>PVC</th>
<th>PE</th>
<th>DUCTILE IRON</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S</td>
<td>XL</td>
<td>S</td>
</tr>
<tr>
<td>Buying</td>
<td>2,74</td>
<td>107,63</td>
<td>3,01</td>
</tr>
<tr>
<td>Installation</td>
<td>59,65</td>
<td>160,45</td>
<td>64,47</td>
</tr>
<tr>
<td>Old pipes dismantling</td>
<td>10,98</td>
<td>37,81</td>
<td>10,98</td>
</tr>
<tr>
<td>Use</td>
<td>25,49</td>
<td>25,49</td>
<td>25,31</td>
</tr>
<tr>
<td>Maintenance</td>
<td>0,17</td>
<td>0,46</td>
<td>0,17</td>
</tr>
<tr>
<td>TCO</td>
<td><strong>99,03</strong></td>
<td><strong>331,85</strong></td>
<td><strong>103,94</strong></td>
</tr>
<tr>
<td>%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum TCO</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For each material the analysis considers different diameters: Small (80-90), Medium (150-180), Large (250-315), Extra Large (500-630).
The results
an example, SEWER - GERMANY

<table>
<thead>
<tr>
<th>Material</th>
<th>PVC</th>
<th>PE corrugated</th>
<th>CLAY</th>
<th>CONCRETE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>XL</td>
<td>M</td>
<td>XL</td>
</tr>
<tr>
<td><strong>Buying</strong></td>
<td>11,1</td>
<td>46,9</td>
<td>13,8</td>
<td>54,8</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
<td>165,0</td>
<td>352,3</td>
<td>165,0</td>
<td>352,3</td>
</tr>
<tr>
<td><strong>Old pipes dismantling</strong></td>
<td>20,0</td>
<td>42,6</td>
<td>20,0</td>
<td>42,6</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>0,5</td>
<td>1,1</td>
<td>0,5</td>
<td>1,1</td>
</tr>
<tr>
<td><strong>TCO</strong></td>
<td>196,6</td>
<td>442,9</td>
<td>199,3</td>
<td>450,8</td>
</tr>
</tbody>
</table>

| % | Minimum TCO | +1,4% | +73,6% | +48,9% |

For each material the analysis considers different diameters: Small (100-125), Medium (300-315), Large (450-500), Extra Large (500-630), Extra Extra Large (800).
PVC products competitiveness

Conclusions

- The TCO of plastics is the lowest among the other materials

- Drinking water networks:
  - Germany: PVC pipes are the best TCO performer. PE is on average 12% more expensive, ductile iron +19%
  - Italy: PVC pipes are the best TCO performer. PE is on average 9% more expensive, ductile iron is +26%

- Sewerage:
  - Germany: PVC pipes are the best TCO performer
  - Italy: corrugated PE pipes are the best TCO performer. PVC is on average 6% more expensive, clay +65%, cement +52%

- The major cost is installation, including road yard, material handling, laying and additional/administrative burdens:
- Initial capital investment in pipes ranges from:
  - In Germany: some 2% of TCO up to 35%, as diameter grows
  - In Italy: some 2-3% of TCO up to 30%, as diameter grows
Window profiles

Outdoor pipes

Flooring
Flooring

Key issues

- Resilient floors have major applications in public buildings and infrastructures.
- In Germany market share of resilient flooring is 18%; carpets have the highest: 35%.
- In Italy resilient floor has 6% of the market; ceramic is the most used material: 74%.
- Both in Germany and in Italy PVC is the material most used: 75% and 80%.
- After PVC, the second material used is linoleum in Germany and rubber in Italy.
- There are many types of products (materials) and different applications (types of use). These are categorized by some international generally accepted principles.

**EN 685 classification**

- 2 = Domestic: light (21), moderate (22), heavy (23)
- 3 = Commercial: moderate (31), general (32), heavy (33), very heavy (34)
- 4 = Industrial: moderate (41), general (42), heavy (43).
**Assumptions**

- The analysis compares different types of resilient floors in two scenarios:
  - light-to-medium traffic: offices, meeting rooms, shops, classrooms
  - heavy traffic areas: hallways, entrances, receptions and waiting rooms
- The final users are companies, shops, hotels, offices, ...
- The life time is 20 years
- All data are adjusted to present value (discount rate: 5%; inflation rate: 2%)

**The conceptual framework for flooring**

<table>
<thead>
<tr>
<th>Purchase</th>
<th>Installation</th>
<th>Cleaning &amp; Maintenance</th>
<th>Removal &amp; Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials costs</td>
<td>Installation costs</td>
<td>Cleaning and maintenance costs</td>
<td>Dismount costs</td>
</tr>
<tr>
<td>List prices</td>
<td>Background preparation</td>
<td>Cleaning costs</td>
<td>Remove old floor covering</td>
</tr>
<tr>
<td>Discount</td>
<td>Labor cost</td>
<td>Maintenance costs</td>
<td>Transport + Disposal</td>
</tr>
<tr>
<td>Joins welding cost</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The results

an example: Germany, Light-to-medium traffic areas

<table>
<thead>
<tr>
<th>PVC Flooring</th>
<th>Initial Cost Material (€)</th>
<th>Initial Cost Installation (€)</th>
<th>Expected life span (y)</th>
<th>Overall Cleaning costs (€)</th>
<th>Overall Maintenance cost (€)</th>
<th>TCO life span (€)</th>
<th>Yearly total cost* (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Vinyl Flooring 2 mm – Sheets - PUR</td>
<td>22,50</td>
<td>13,60</td>
<td>20</td>
<td>106,17</td>
<td>-</td>
<td>142,27</td>
<td>7,11</td>
</tr>
<tr>
<td>Standard Rubber Flooring 2 mm - Sheets</td>
<td>24,54</td>
<td>13,60</td>
<td>20</td>
<td>106,17</td>
<td>21,46</td>
<td>165,76</td>
<td>8,29</td>
</tr>
<tr>
<td>Standard PVC Flooring 2 mm - Sheets</td>
<td>15,85</td>
<td>13,60</td>
<td>20</td>
<td>106,17</td>
<td>50,29</td>
<td>185,91</td>
<td>9,30</td>
</tr>
<tr>
<td>Linoleum 2,5 mm</td>
<td>21,47</td>
<td>13,60</td>
<td>20</td>
<td>106,17</td>
<td>50,29</td>
<td>191,53</td>
<td>9,58</td>
</tr>
</tbody>
</table>

*Installation costs and cleaning costs are the same for all products.
## The results

**an example: Italy, Heavy traffic areas**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Initial Cost Material</th>
<th>Initial Cost Installation</th>
<th>Expected life span (y)</th>
<th>Overall Cleaning costs</th>
<th>Overall Maintenance cost</th>
<th>TCO life span</th>
<th>Yearly total cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Vinyl Flooring 2 mm – Sheets</td>
<td>30,90 €</td>
<td>13,60 €</td>
<td>20</td>
<td>250,23 €</td>
<td>- €</td>
<td>294,73 €</td>
<td>14,74 €</td>
</tr>
<tr>
<td>Top Rubber Flooring 2 mm - Sheets</td>
<td>37,00 €</td>
<td>13,60 €</td>
<td>20</td>
<td>250,23 €</td>
<td>- €</td>
<td>300,83 €</td>
<td>15,04 €</td>
</tr>
<tr>
<td>Mid-end Vinyl Flooring 2 mm - Sheets</td>
<td>19,03 €</td>
<td>13,60 €</td>
<td>20</td>
<td>250,23 €</td>
<td>72,83 €</td>
<td>355,69 €</td>
<td>17,78 €</td>
</tr>
<tr>
<td>Standard Rubber flooring 2 mm - Sheets</td>
<td>23,10 €</td>
<td>13,60 €</td>
<td>20</td>
<td>250,23 €</td>
<td>72,83 €</td>
<td>359,76 €</td>
<td>17,99 €</td>
</tr>
<tr>
<td>Standard Vinyl Flooring 2 mm - Sheets</td>
<td>13,40 €</td>
<td>13,60 €</td>
<td>20</td>
<td>250,23 €</td>
<td>105,22 €</td>
<td>382,45 €</td>
<td>19,12 €</td>
</tr>
<tr>
<td>Linoleum 2,5 mm</td>
<td>19,29 €</td>
<td>13,60 €</td>
<td>20</td>
<td>250,23 €</td>
<td>105,22 €</td>
<td>388,34 €</td>
<td>19,42 €</td>
</tr>
</tbody>
</table>

*Installation costs and cleaning costs are the same for all products.*
PVC products competitiveness

Conclusions

- Products with different properties can be suitable for the same applications
- The lowest purchase, not necessarily the lowest TCO
- The materials with the lowest purchase costs have an higher life cycle costs compared to others due to higher maintenance requirements
- How buyers can save money?
  - Comparing the full costs over the product life time of purchasing, installing, using and maintaining alternative products
- For heavy traffic, cleaning and maintenance costs can account up to 92% of the total cost of ownership if low-end PVC and rubber floors are installed
- The high-end floorings have the lowest maintenance cost per square meter, and therefore the lowest total cost of ownership
4. Conclusions

- The analysis compares all the costs along the life of a product of different materials, not only the buying one.

- For all the products (windows, pipes and flooring) PVC results the material having the lowest TCO and the shortest pay back period.

  - **Windows.** PVC has the lowest purchase cost, the fastest returns and the shortest pay back time: Germany 8 years, Italy 12 years.

  - **Pipes**
    - **Drinking water.** Both in Germany and in Italy PVC is the best TCO performer and has the lowest initial cost.
    - **Sewerage.** In Germany PVC is the best TCO performer; In Italy corrugated PE and PVC are close, < Clay and Concrete.

  - **Flooring.** Vinyl is the best TCO performer. PVC has the lowest initial cost and the lowest TCO over life span.
© Copyright Althesys 2011. All rights reserved.

alessandro.marangoni@althesys.com