Outlook Large Diameter Pipes – Market and Technologies

- Presentation EUROPIPE
- Pipe Market
- Technological Developments
  - Sour Gas Resistant Pipes
  - Collapse Resistant Pipes
  - Construction Pipes
- References in the Market Middle East
- Market Position of EUROPIPE
- Summary
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More than 120 years Experience in Manufacturing Pipes
Our long History

Foundation of Dillinger Hütte 1685
Pipe Delivery
Skew Rolling

Mannesmann Share
Mannesmann Brothers
Advertisement for seamless pipes 1916
Shareholders of EUROPIPE GmbH

AG der Dillinger Hüttenwerke / Dillingen

Salzgitter Mannesmann GmbH / Salzgitter

EUROPIPE GmbH
Mülheim an der Ruhr / Germany

50%

50%
Production Range SAWL and SAWH Pipes

<table>
<thead>
<tr>
<th>Outside diameter</th>
<th>SAWL Pipes</th>
<th>SAWH Pipes</th>
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</thead>
<tbody>
<tr>
<td>mm</td>
<td>inch</td>
<td>mm</td>
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<tr>
<td>1626</td>
<td>64</td>
<td>4.8</td>
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<td>1524</td>
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</tr>
<tr>
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<td>1118</td>
<td>44</td>
<td>30.2</td>
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<tr>
<td>1016</td>
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<td>39.7</td>
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<td></td>
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<tr>
<td>406</td>
<td>16</td>
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</table>

Other dimensions are available upon request.
Range of Supporting Activities

- Technical support, consulting
- Coatings and linings
- Bends, anodes
- Information technology / PRODIS
- Logistics
- Research and development

A Proactive Approach
Seizing new opportunities through ongoing improvement

- High-strength pipe: X80 to X100
- HIC-resistant pipe: all grades up to X70
- Collapse-resistant pipe: optimisation of size and grade
- Arctic grades up to X80
## Mill Capacities per Month

<table>
<thead>
<tr>
<th>Pipe mill</th>
<th>Technique</th>
<th>2 Shifts / day</th>
<th>3 Shifts / day</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>kt</td>
<td>km</td>
</tr>
<tr>
<td>Mülheim (18 m line)</td>
<td>UOE</td>
<td>85</td>
<td>125</td>
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<tr>
<td>Mülheim (12 m line)*</td>
<td>TRB+E</td>
<td>5</td>
<td>15</td>
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<tr>
<td>Dunkerque</td>
<td>UOE</td>
<td>25</td>
<td>60</td>
</tr>
<tr>
<td>BSPC / Panama City</td>
<td>TRB</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>BSPM / Mobile</td>
<td>helically</td>
<td>12</td>
<td>42</td>
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<td><strong>Mills total</strong></td>
<td></td>
<td>152</td>
<td>317</td>
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</table>

*1 Shift per day
### Project References

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Country</th>
<th>Diameter (Inch)</th>
<th>Length (Km)</th>
<th>Material</th>
<th>Quantity (t)</th>
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</thead>
<tbody>
<tr>
<td>1. 36” Allwas</td>
<td>Egypt (03)</td>
<td>36” Allwas Pipeline</td>
<td>Egypt</td>
<td>X70</td>
<td>2,000 t</td>
</tr>
<tr>
<td>2. 36” Allwas</td>
<td>Egypt (03)</td>
<td>36” Allwas Pipeline</td>
<td>Egypt</td>
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<td>4,000 t</td>
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<td>3. 26” Europipe</td>
<td>Iran (03)</td>
<td>26” Europipe Pipeline</td>
<td>Europe</td>
<td>X65</td>
<td>3,000 t</td>
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<td>4. 24” Europipe</td>
<td>Canada (03)</td>
<td>24” Europipe Pipeline</td>
<td>Canada</td>
<td>X65</td>
<td>5,000 t</td>
</tr>
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<td>5. 30” Europipe</td>
<td>Canada (03)</td>
<td>30” Europipe Pipeline</td>
<td>Canada</td>
<td>X65</td>
<td>7,000 t</td>
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<tr>
<td>6. 32” Europipe</td>
<td>Canada (03)</td>
<td>32” Europipe Pipeline</td>
<td>Canada</td>
<td>X65</td>
<td>9,000 t</td>
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<tr>
<td>7. 34” Europipe</td>
<td>Canada (03)</td>
<td>34” Europipe Pipeline</td>
<td>Canada</td>
<td>X65</td>
<td>11,000 t</td>
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<tr>
<td>8. 36” Europipe</td>
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<td>36” Europipe Pipeline</td>
<td>Canada</td>
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<td>9. 38” Europipe</td>
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<td>40” Europipe Pipeline</td>
<td>Canada</td>
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<td>17,000 t</td>
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<td>11. 42” Europipe</td>
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<td>42” Europipe Pipeline</td>
<td>Canada</td>
<td>X65</td>
<td>19,000 t</td>
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</tbody>
</table>

---

*Note: The above table lists a selection of projects with their respective details, including pipeline diameters, lengths, materials, and quantities.*
Nord Stream I & II
The new gas supply route for Europe

Customer: Nord Stream
Usage: Offshore
Medium: Gas
Steelgrade: SAWL 485 IFD · LSAW
Total Length: 2,440 km
EUROPIPE Length: 1,840 km
EUROPIPE Tonnage: 1,600,000 t
Size: 48” x 26.8 - 34.6 mm
Year: 2008 - 2011
Nord Stream Pipe Stock in Mukran (Germany)
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Global Gas Resources
Conventional vs. Unconventional Gas

Trend: Globally increasing gas demand leads to exploitation of new gas fields in challenging environment

Reference Production 2009: 3 tcm

Source: Erdöl, Erdgas, Kohle 2010; BP 2010; *Trillion (English) = Billionen (German) and BGR 2009, Gas Resources end of 2007
Global Gas Reserves
Proven Reserves of Conventional Gas

- The Middle East and the former Soviet Union jointly hold 65% of the world's gas reserves

Source: Eni, Sep. 2011
Pipeline Projects since 2009 / 2010 & beyond (km) by different sources

- MBR: Five Year Outlook LDP (Major new pipelines >=2008)
- Oil & Gas Journal: as of 02/2011 (LD Pipe >=22’’)
- Pipeline & Gas Journal: as of 08/2011 (North America: does not include planned pipelines in Canada and Mexico)
- SIMDEX: as of 05/2011 (LD Pipe >=22’’, Pipelines planned and under construction, >=2011)

Asia Pacific Region note:
- Oil & Gas Journal and Simdex: incl. Regions east of the Ural and south of the Caucasus
- Pipeline & Gas Journal: excluding the FSU
- Simdex: CIS (50% Asia;50% Europe to Ural)
World Exports by LNG and Pipeline

- **LNG** without significant relevance, but with relatively high annual growth rates

O&G World Oil and Gas Review 2011

Exports include not only volumes of natural gas produced and exported, but also those bought and re-sold to third parties. Exports - LNG exports.
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Sour Gas Resistant Pipes

- Exploration of H$_2$S containing gas

Wet H$_2$S damages steel structure by hydrogen induced cracking (HIC) and sulfide stress cracking (SSC)

- Gas is dried and H$_2$S removed in treatment plants

If treatment plant has a breakdown

- Steel has to resist corrosion attack for limited period

⇒ Special precautions in steel plant

⇒ Low carbon, low manganese chemistry, but max 1.6 Mn is possible

hot metal desulphurisation dephosphorisation decarburisation during converter proc vacuum tank degassing cleanness stirring Ca-treatment continuous casting with segregation control
# Sour Gas Resistant Pipes

## X70; 20” x 19.1mm
### Chemistry

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>P</th>
<th>S</th>
<th>Others</th>
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</thead>
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<tr>
<td></td>
<td>0.04</td>
<td>1.6</td>
<td>0.3</td>
<td>.011</td>
<td>.0005</td>
<td>Cu, Ni, Cr, Nb, Ti</td>
</tr>
</tbody>
</table>

### X70 properties

- **Tensile tests (strength)**
  
<table>
<thead>
<tr>
<th></th>
<th>$R_{10.5}$</th>
<th>$R_m$</th>
<th>$A_2$%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>500 MPa</td>
<td>585 MPa</td>
<td>45 %</td>
</tr>
</tbody>
</table>

- **Charpy tests (toughness)**
  
  - Upper shelf level BM: 300J
  - Sufficient toughness of HAZ and WM at -20°C
  - HIC test @ pH3, 1bar $p_{H_2S}$ (corrosion) acc to NACE TM 0177 sol. A
  - No indications
  - SSC test @ pH3, 1bar $p_{H_2S}$ (corrosion) acc to NACE TM 0177 sol. A
  - No cracks

## X80; 20” x 19.1mm
### Chemistry

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<tr>
<th></th>
<th>C</th>
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<th>Si</th>
<th>P</th>
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<th>Others</th>
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</table>

### X80 properties

- **Tensile tests (strength)**
  
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<th>$R_m$</th>
<th>$A_2$%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>590 MPa</td>
<td>690 MPa</td>
<td>35 %</td>
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</table>

- **Charpy tests (toughness)**
  
  - Upper shelf level BM: 320J
  - Sufficient toughness of HAZ and WM at -20°C
  - HIC test @ pH3, 1bar $p_{H_2S}$ (corrosion) acc to NACE TM 0177 sol. A
  - Indications in specified range
  - SSC test @ pH3, 1bar $p_{H_2S}$ (corrosion) acc to NACE TM 0177 sol. A
  - No cracks
Sourgas References

![Bar Chart]

- **Quantity [mt]**: 0 to 700,000
- **Data**:
  - 2007: Large peak
  - 2006: Small peak
  - 2003: Medium peak
  - Other years: Lower quantities
### Sourgas References

<table>
<thead>
<tr>
<th>Year</th>
<th>Grade</th>
<th>Dia</th>
<th>WT</th>
<th>Med</th>
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<td>20.6-25.4</td>
<td>Gas</td>
<td>3</td>
<td>187000</td>
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</tbody>
</table>

Since 1991 delivery of 3.246.075 t sourgas resistant linepipe in diameters from 508 to 1422 mm with wall thicknesses from 9.5 to 36.8 mm.
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Collapse Resistant Pipes

For deep sea applications pipes are stressed by external pressure
  e.g. Black Sea down to 2500 m equals 250 bar
  e.g. Oman-India down to 3500 m equals 350 bar
⇒ collapse resistance of pipelines is mandatory
⇒ (depending on diameter, wall thickness, grade, ovality)

Developments
- improving compression yield strength by thermal treatments
- improving shape of pipes in improving ovality with optimised equipment
Collapse Resistant Pipes

Recovery of yield strength by heating during pipe coating
⇒ has effect on collapse behaviour

![Graph showing the effect of heating on collapse pressure and wall thickness for SAWL 485 and SAWL 450 pipes.]

- External pressure: 220 bar (2200 m water depth)
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Example: Pressurized Natural Gas (PNG®)

Joint Venture (02/02)  Knutsen OAS Shipping
- development and achievement of approval for cargo tank cylinders (CTC) suitable for the PNG requirements
- supply of sufficient CTC’s for all PNG projects
- support Knutsen OAS Shipping in marketing and acquisition

Patent and Trademark HIFA®-Pipe
- EUROPIPE developed special treatment of the long seam to achieve fatigue performance required for PNG application

Full DNV Approval for CTC
- DNV granted full approval for EUROPIPE’s CTC based on HIFA-Pipes to be used in PNG technology

Application for Projects
- support of Knutsen OAS Shipping with EUROPIPE’s strengths to enter this totally new business
Example: Offshore WEA Foundations

**Joint Venture**

- jointly development and marketing of the mass production of high load resistant wind turbine foundations with standard elements

**OGOWin**

- participation in the governmental supported R&D program for the optimization of high load resistant foundations for offshore wind turbines in regards of optimized assembly, manufacturing and selected materials

**Prototype Bremerhaven**

- Joint venture received from Repower the order to deliver the foundation for the M5000 Prototype in Bremerhaven. Scheduled transfer to REpower end of 2007. The job was full on schedule and proved the developed concept being valid.

**Future „offshore projects“**

- due to the positive experiences with the Prototype Foundation Bremerhaven the JV is in the application for several larger offshore wind energy parks
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Dolphin Energy, UAE
Taweelah – Fujairah Gas Pipeline

Year: 2009  250 km / 119,000 t  48" x 14.3 - 17.5 mm  X70 non-sour
Taweelah – Fujairah Gas Pipeline
Taweelah – Fujairah Gas Pipeline
IPIC, UAE  

Abu Dhabi Crude Oil Pipeline Project  

Year: 2009  
160 km / 94,600 t  
48“ x 14.3 - 25.4 mm  

Material Grade: X65 sour  

IPIC 48“ Crude Oil Line from Habshan oil fields (Abu Dhabi) to oil export terminal in the Emirate Fujairah (bypassing the Strait of Hormuz).
References in the Market Middle East

GASCO/Linde, UAE

Elixier 2 Project, Mirfa to Habshan

2010

44 km / 19,825 t
48" x 14.3 – 28.6 mm

Material Grade: X65 non-sour
# References in the Market: Middle East

<table>
<thead>
<tr>
<th>Year</th>
<th>Customer</th>
<th>Project</th>
<th>Dimension</th>
<th>Grade</th>
<th>Quantity</th>
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</thead>
<tbody>
<tr>
<td>2009</td>
<td>Qatar Petroleum</td>
<td>Strategic Gas Transmission Project</td>
<td>36” x 12.7-15.9mm</td>
<td>X65 sour</td>
<td>298km/82,000t</td>
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<tr>
<td>2007</td>
<td>Qatar Petroleum</td>
<td>Doha Urban Pipeline Relocation</td>
<td>36” x 14.3-17.5mm</td>
<td>X65 sour</td>
<td>134km/45,000t</td>
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<tr>
<td>2007</td>
<td>Khalda Petroleum, Egypt</td>
<td>Qasr-Salam Pipeline Project</td>
<td>24”x31.0mm</td>
<td>X65 non-sour</td>
<td>37km/16,400t</td>
</tr>
<tr>
<td>2002-2004</td>
<td>RasGas</td>
<td>RasGas Offshore Expansion Project</td>
<td>28”-38” x 21.6-33.1mm</td>
<td>X65 sour</td>
<td>221km/139,900t</td>
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<tr>
<td>2002</td>
<td>GASCO, UAE</td>
<td>Ruwais-Shuweihat Gas Pipeline</td>
<td>36”-42” x 17.5-25.4mm</td>
<td>X60 sour</td>
<td>20.4km/9,200t</td>
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<td>2002</td>
<td>Saudi Aramco</td>
<td>Abu Safah</td>
<td>20”/30”/42”x15.9-25.4mm</td>
<td>X60 sour</td>
<td>83km/45,200t</td>
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<td>2001</td>
<td>Qatar Petroleum</td>
<td>Khuff Gas Line Replacement</td>
<td>20”-36” x 12.7-19.1mm</td>
<td>X65 sour</td>
<td>103km/28,000t</td>
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<td>2000</td>
<td>Atheer, UAE</td>
<td>Maqta-Jebel Ali Gas Pipeline</td>
<td>24”/36”/48” x 10.4-19.8mm</td>
<td>X60 sour</td>
<td>134km/70,000t</td>
</tr>
</tbody>
</table>
## References in the Market Middle East

<table>
<thead>
<tr>
<th>Year</th>
<th>Customer</th>
<th>Project</th>
<th>Dimension</th>
<th>Grade</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>Petrobel, Egypt</td>
<td>Temsah Development Project</td>
<td>32&quot; x 22.2-31.5mm</td>
<td>X65 non-sour</td>
<td>65km/29,200t</td>
</tr>
<tr>
<td>1999</td>
<td>Petrobel, Egypt</td>
<td>Intersinai Gas Pipeline</td>
<td>36&quot; x 14.3-22.2mm</td>
<td>X70 non-sour</td>
<td>195km/62,800t</td>
</tr>
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<td>1998</td>
<td>PDO, Oman</td>
<td>GGS Interlink Pipeline</td>
<td>28&quot; x 9.5-11.4mm</td>
<td>X70 non-sour</td>
<td>98km/17,500t</td>
</tr>
<tr>
<td>1997</td>
<td>PDO, Oman</td>
<td>Oman LNG Project</td>
<td>32&quot; x 14.0mm</td>
<td>X70 non-sour</td>
<td>46km/17,700t</td>
</tr>
<tr>
<td>1997</td>
<td>Bapetco, Egypt</td>
<td>Obaiyed Pipeline Project</td>
<td>22&quot;-34&quot; x 10.3-16.1mm</td>
<td>X65 non-sour</td>
<td>367km/99,200t</td>
</tr>
<tr>
<td>1994</td>
<td>Qatargas</td>
<td>Qatargas Upstream Development</td>
<td>32&quot; x 22.2-31.1mm</td>
<td>X65 sour</td>
<td>82km/35,500t</td>
</tr>
</tbody>
</table>
References in the Market Middle East

**Formula 1 Race Track; Yas Marina Circuit; Abu Dhabi**

2009 Roof Construction West Grand Stand Curve
1.3 km / 293 t / 119 pipes  30“ x 12.50 mm

Material Grade:  S 355 J2H acc. to EN 10219-1
Formula 1 Track, Abu Dhabi
Formula 1 Track, Abu Dhabi
Outlook Large Diameter Pipes – Market and Technologies

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Market Position of EUROPIPE (1)

- The key to success is world-class manufacturing on an outstanding level of quality and quantity.

- The steel used by EUROPIPE is produced in the steel plants of our shareholders.

- The steel plate delivered is always tailored to given project specifications.

- EUROPIPE mills in Europe are integrated.

- The Mülheim 18m line has by far the largest manufacturing facilities worldwide.

- Since its foundation in 1991, the company has supplied its customers with perfect products. And that means production and delivery of more than 10 million tons of large-diameter pipe – more than 27,500 km.

- EUROPIPE is participating in major onshore- and offshore pipeline projects all over the globe.
Market Position of EUROPIPE (2)

- The MENA region is and *always* was an extremely important market for EUROPIPE over the decades.

- EUROPIPE has supplied significant quantities of large-diameter pipes to a variety of major projects in this region. Our supplies included - but were not limited to - huge quantities for **sour applications** onshore and offshore.

- All customers and all projects receive EUROPIPE‘s highest attention at any time.

- In the last years we observed a severe pressure on the pipe prices. Even pipes with extreme severe requirements are partwise sold below costs.

- „The Bitterness of poor quality remains long after the sweetness of low price is forgotten“

- EUROPIPE was and will be also in the future the by far most profitable large-diameter pipe manufacturer worldwide
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Summary

➢ It could be demonstrated, that the key to success in all Markets is world-class manufacturing on an outstanding level of quality and quantity.

➢ Technological developments are a mandatory prerequisite, and specially for the Market MENA sour service and collapse resistant steels are required.

➢ We are prepared to supply all Grades and pipe dimensions to all customers in this region.

➢ For EUROPIPE this Market is extremely important, but beside a good loading of our mills it is also understandable that a certain profit is necessary.
Thank You for Your kind Attention