Independent innovation organization servicing European and International manufacturers and governments

- **Focus on Chemical, Energy and Environmental Technologies**
  - Green chemistry (solvent substitution, biodegradable materials, biomass products)
  - Alternative energy and energy efficiency
  - Pollution control (water treatment, greenhouse gas removal, air processing)

- **Unique Capabilities and Impacts**
  - Process Innovation
  - Process Integration
  - Process Intensification

- **Development of significant portfolio of Intellectual Property**

- **Built on successful business model from United States**
  - MATRIC (USA) has been in existence for 5 years
  - 150+ scientists and engineers; many with industrial experience from Union Carbide or Dow Chemical
  - Two licenses and 12 companies started using MATRIC intellectual property
Built on MATRIC’s Success in USA

• MATRIC is non-profit research and development corporation formed in 2004
  – Reinvest earnings in new research
  – Offices in throughout the USA
• Research and engineering staff of over 150
  – 40 PhD-level researchers
  – 25+ average years of experience
  – 2 members of National Academy of Engineering
• MATRIC has a focus on developing intellectual properties for commercial and industrial customers
• Significant portfolio of over 100 projects and a variety of customers, such as:
  – Large industrial customers (Chevron, Exxon, Dow, UOP)
  – Small innovation companies (BEST Energies, DNP, Novamer)
  – Government agencies (Energy, Defense, NASA, EPA)

MATRIC was formed from the downsizing of over 2000 research scientists and engineers located at the Union Carbide Tech Center, South Charleston, WV from 2001-2008
MATRIC Europa will be located at the Insubria BioPark outside of Milano, Italy.

- Former multi-national pharmaceutical research complex
- Available chemical and biological laboratories
- Significant analytical equipment
- Easy access to Malpensa Airport
Laboratory and Pilot-Scale Research and Development to Create New Innovation (intellectual property development)

Professional Engineering to Implement Innovation (detailed design, construction management, operations training)

Commercialization to Access Markets (license or start-up companies)
Biomass Product Development
- Bio-polymers
- Bio-char

Fossil Fuels Product Development
- Coal to Liquids/Chemicals
- Coal Gasification
- Petroleum products
- Natural gas products

Commodity Chemical Process Optimization
- Heat Integration/PINCH
- Solvent Replacement
- Catalyst Development

Pharmaceutical Process Optimization
- Solids Handling
- Statistical Process Enhancement
Energy Technologies

- **Biomass Fuels**
  - Biodiesel
  - Corn and Cellulosic ethanol
  - Biomass gasification
  - Biomass digestion
  - Landfill gas

- **Fossil Fuels**
  - Integrated Gasification Combined Cycle
  - Oxyfuel Combustion
  - Coal Waste Utilization
  - Coal Weather Conditioning

- **Alternative Energy**
  - Materials for solar, wind and hydroelectric
  - Energy storage

MATRIC Europa
Environmental Technologies

- **Greenhouse Gas Control**
  - Carbon dioxide capture and sequestration
  - Methane recovery
- **Water purification**
  - Desalination
  - Selenium and metals removal
  - Mercury removal
  - Organics removal
  - Acid mine drainage
- **Soils Remediation**
  - Radioactive materials
  - Mercury
- **Fossil Fuels Purification**
  - Non-BTU content in natural gas
  - Sulfur in coal
Capabilities and Impacts
Process Innovation

Process and Product Development
- Economic-directed laboratory research
- Quality by Design methodology
- Scale-up, pilot plant development & demonstration
- Product manufacture for market introduction & testing

Advanced Chemical Separations
- Reverse osmosis membranes
- Pressure-swing adsorption
- Temperature-swing adsorption
- Non-aziotropic distillation
- Crystallization

Advanced Catalysis
- Catalyst design & scale-up
- Testing & modeling
- Substrate design
- Reaction engineering
Capabilities and Impacts

Process Integration

Heat and Mass Optimization

- Reductions in energy consumption
- Reductions in feedstock and solvent quantities

Reactive Separations

- Combining critical process steps

Waste Minimization and Utilization

- Reduction of non-value added byproducts
- Use of byproducts for process improvements
Capabilities and Impacts
Process Intensification

Micro-Channel Reactors
- Enhanced heat transfer
- Pressure containment
- Catalyst efficiency
- Hazardous intermediate minimization

Micro-separations
- Membranes, distillation and extraction

Micro-Analytical Instrumentation
- Micro-LC
- GCxGC
- Fringe Field Sensors
- Vapochromic Sensors
- Raman
- RFID Communication
- Surface Plasmon Resonance
- Mini-NMR

Micro-Sampling Systems
- Valves, Regulators, Adaptors, Sample ports
Engineering Processes and Skills

- **Detailed Engineering**
  - Process engineering
  - Control system engineering
  - Electrical system engineering
  - Mechanical engineering
  - Civil engineering
  - Drafting

- **Procurement**
  - Major/Minor equipment
  - Bulk material

- **Construction Management**
  - Construction oversight
  - Process Representation

- **Operations Training and Start-up**
  - Occupational safety training
  - Process operations training
  - Plant process start-up support

- **Project Management**

---

Project Development Schedule

- Explore Market Need
- Develop Concept for Product
- Design Development Cycle
- Develop Tool
- User Interface Final Evaluation
- Alpha Version Release
- Quality Assurance Testing Phase 1
- Fix Outstanding Problems from Alpha
- Beta Version Release
- Quality Assurance Testing Phase 2
- Fix Outstanding Problems from Beta
- Design Review and GO-Let
- Begin Advance Advertising Campaign
- FCS Repeatability
- Final Quality Assurance Testing
- FCS Release
- Production and Packaging

MATRIC Europa
Unique ability to offer innovation from laboratory discovery through operation of full scale production
Commercializing Innovative Technology

Proven Commercialization Process

- IP Creation
- 3rd Party Market Assessment
- Capitalization
- Business Planning
- IP Protection

MATRIC Europa
<table>
<thead>
<tr>
<th>Organization</th>
<th>Product</th>
<th>Customer Market</th>
<th>Business Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>PolyPlexx</td>
<td>Optically transparent and bullet resistant polymer technology initially focused on the optical lens market.</td>
<td>Optical lens applications, transparent armor and other advanced polymer applications.</td>
<td>Applications licensing to large international players with a focus on specific applications.</td>
</tr>
<tr>
<td>NGInnovations</td>
<td>Solutions to treat water high in total dissolved solids for economical disposal</td>
<td>Natural gas producers that utilize high volumes of water in exploration and drilling or experience produced water from gas wells.</td>
<td>Lease solutions to large natural gas producers or natural gas service providers.</td>
</tr>
<tr>
<td>Liberty Hydrologic Systems</td>
<td>Treatment systems which remove water pollutants from extraction industry sources, including removing selenium and metals.</td>
<td>Mining companies, smelting operations, agricultural interests and other where water contaminants are a regulatory compliance concern.</td>
<td>Providing services and systems under sales, services and leasing arrangements.</td>
</tr>
<tr>
<td>Mountaineer Biofuels, LLC</td>
<td>Pyrolysis and biodiesel technologies.</td>
<td>Energy companies, transportation companies, organizations needing forest reclamation.</td>
<td>Selling end products including biofuel, gases, biochar, and/or electricity.</td>
</tr>
<tr>
<td>Certus Scientific</td>
<td>Woman-owned government services business eligible for small business set asides in certain federal procurements</td>
<td>Federal customers including Department of Energy and NASA.</td>
<td>Selling services across a variety of agencies.</td>
</tr>
</tbody>
</table>
Key Partnerships

Leveraging the full capabilities of MATRIC in the United States
MATRIC Europa will perform high value-added, fast-paced, market-driven research, development and engineering for companies and governments that need to reach the market quickly and effectively.

MATRIC Europa’s superior performance is due to its:

- Leadership, scientists and engineers have a long heritage successfully developing processes, products and services in the commercial marketplace.
- Seamless integration of technical disciplines from idea generation through manufacturing.
- Quick response to customer requirements through rapid deployment of talented teams and execution of focused project plans.
- Exceptional value for customers throughout the life of the project.
- Solutions for the spoken and unspoken problems of our customers.
Industry strongly favors mission-oriented RD&E, and there is much to learn about it by most established companies.

MATRIC Europa’s agile, entrepreneurial RD&E organization may be impossible to reproduce in highly organized, hierarchical companies.

MATRIC Europa’s RD&E business model has the potential to become a major supplier of innovation to job-creating industries throughout Italy and the EU.

MATRIC Europa’s ability to create technology that support economically viable manufacturing will be greatly advantaged in the European marketplace.
Three-Year Business Plan

**Year 1**
- Hire Management and Technical Leadership
- Establish Laboratory Facilities at Gerezano
- Develop sales channels through relationship marketing

**Year 2**
- Establish robust portfolio of research, development and engineering projects
- Establish intimate working relationships with trade associations, government agencies and universities
- Establish start-up manufacturing companies using MATRIC USA intellectual properties

**Year 3**
- Establish first commercialization activities using MATRIC Europa intellectual properties
- Establish international research collaborations of significant magnitude
Three-Year Capital Requirements

Total three-year capital requirement of $4,000,000 USD/ 2,800,000 euros

MATRIC USA
- $500,000 direct investment
- Management and technical processes
- Initial intellectual property contribution

Equity Capital
- $2,000,000 sale of 30% equity
  - Equity includes MATRIC Europa retained earnings, increases in corporate capital, participation in portfolio of start-up manufacturing companies

Governmental Sources
- $1,000,000 economic development investment

Sales
- $500,000 retained earnings