Pall Overview
Industrial BioTechnology
Enabling Industry Solutions

Doug DiLillo
Syracuse, NY
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Sustainable, Profitable Growth
A Brief History of Pall Corporation
Developing Filtration Technology

- **1946: Company founded**
- **1960s: Business expands**
  - Sales reach $6.7 million in 1960
  - Pall Europe Limited formed in 1966
  - Major contribution to hydraulic system cleanliness
- **1970s: Leader in fine filtration**
  - Sales reach $88 million in 1978
  - Europe & Asia account for 40% of sales
  - Major contribution in medical applications
- **1980s & 1990s: Global growth opportunities**
  - Major contributions in Energy, Pharmaceuticals,
  - Micro & Macro Electronics and Fluid Power
  - Industries rely on Pall for sub-micronic filtration
- **2010: Sales exceeding $2.5 billion**
Two separate, integrated businesses each with its own global manufacturing, R&D, sales, marketing, and technical support.
Scientific & Laboratory Services (SLS)

- 175+ people worldwide
- 29 locations
  - 4 laboratory Centers of Excellence
  - Cortland, NY, USA
  - Port Washington, NY, USA
  - Bad Kreuznach, Germany
  - Tsukuba, Japan
- Technical, Application and Product Support for Sales/Marketing, R&D, and Customers
- Topic area experts work across borders, geographies and markets and serve as partners and consultants
Pall is headquartered on Long Island, NY and has a main Industrial Technical Center in Cortland, NY.
Welcome to Pall Cortland

• Manufacturing
• Research & Development
• Pall Advanced Separation Systems (PASS)
Pall Cortland was established in 1961 (purchased from Trinity Equipment Company)

- Employs over 700 associates
- Over .5 million square feet (46,000 square meters) of production, office, and laboratory space
Pall Technologies

- Filter elements
- Coalescer elements
- Filter systems
- Crossflow technology
- Filter sheets and modules
Enabling Industrial Sustainability Solutions for Energy

Pall’s committed to advancing technologies that create value for our customers with a focus on Renewable and Alternate Energy markets.
Mission Statement

Pall will provide enabling products, technologies and process development services to Industrial Biotechnology developers.

We will help diversify global fuel supplies, reduce greenhouse gas emissions, enhance rural economic opportunities, and provide sustainable energy alternatives.
Applications

• BioDiesel - Diesel fuel from renewable resources
  Transesterification or enzymatic reactions
  Green Diesel using hydrogenation process

• BioAlcohol - Fuel Alcohols from renewable resources
  Fermentation of sugars including cellulosic
  From BioMass gasification into SynGas,
  then catalytic or fermentation conversion

• BioProcess - Fuels made using BioReactor processes
  Organisms making liquid fuels directly
  Algae BioMass BioBased Fuels & Chemicals

• BioCatalysis - Chemicals made in BioReactor processes
  Organisms making chemicals through enzymatic pathways
Algal BioMass Concentration Application

CO₂
Nutrients & H₂O

Algae Ponds
Photo BioReactors

Concentrated Algae BioMass

Downstream Processing

PALL Crossflow Membranes

Fuel
Energy

Oils
Proteins
Carbohydrates
Others

MicroFiltered Growth Medium available for reuse
Using and Expanding Our Core Competency:  
Total Fluid Management℠ (TFM)

• Pall partners with its customers in TFM to develop solutions for their toughest fluid management challenges

• We gain extensive knowledge of the process enabling the identification of additional opportunities for optimization

• Deepens and strengthens senior-level customer relationships

• Differentiates Pall as the leader in Total Fluid Management
BioDiesel on an Industrial Scale
Pall’s Process Separation Solutions

Where to Apply Pall’s Separation Equipment:

F1R: Filter the Crude or Refined Feed Oil
- Pall’s absolute-rated liquid particulate filters
- Pall’s ZHF centrifugal discharge filter system

F2L2: Separate Glycerol or H₂O/MeOH from ME
- Pall’s liquid/liquid coalescers

F3L3: Separate Glycerin from ME
- Pall’s liquid/liquid coalescers

F4L4: Separate Wash Water from BioDiesel
- Pall’s liquid/liquid coalescers

F5L5R5: Wash Water Recovery
- Pall’s liquid/liquid coalescers
- Pall’s DT RO water purification system

F6L6: Separate ME from Glycerin
- Pall’s liquid/liquid coalescers

F7: Glycerin Purification
- Pall’s absolute-rated liquid particulate filters
- Pall’s SupraDisc™ II depth filter modules

F8: BioDiesel Purification
- Pall’s absolute-rated liquid particulate filters
- Pall’s SupraDisc™ II depth filter modules
- Pall’s ZHF centrifugal discharge filter system

BioDiesel
Fuel Ethanol

1. BioMass
2. Mill
3. Slurry Tank
4. Jet Cooker
5. Saccharification
6. Fermentation
7. Enzymes
8. Yeast
9. Mash Cooling
10. Beer
11. 30°C
12. Side Stripper
13. Beer stripper
14. Rectifier
15. Molecular Sieves
16. Evaporator
17. 200 Proof EtOH
18. Gasoline
19. Final Product Loadout filter
20. Final Product Filter
21. 200 Proof Denatured EtOH
22. DDG
23. Wet Grain
24. Rotary Drum
25. Whole Stillage
26. Centrifuge
27. Membrane separation of solids. Coalescer for oil recovery.
28. Syrup
29. EtOH recycle
30. Mole Sieve
31. Trap filter
32. 90°C
33. Closed loop glycol filter
34. Sterile air, water & vent filtration
35. CO₂
36. Liquefied CO₂ filter
37. LG coalescer for compressor protection
38. Sterile air, water & vent filtration
39. Steam filter
40. Water filter
41. EtOH recycle
42. Mole Sieve
43. Trap filter
44. Beer Stripper
45. Rectifier
46. Side Stripper
47. Molecular Sieves
48. Evaporator
49. 200 Proof EtOH
50. Gasoline
51. Final Product Loadout filter
52. 200 Proof Denatured EtOH
53. DDG
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71. 200 Proof Denatured EtOH
72. DDG
Total Fluid Management - Our Fundamental Strategy

- Addressing industry needs with a broad array of technologies and services
- Licensor development and process integration
  - Active collaboration with developers and licensors in the field of renewable and alternative energy
- Product & application development
  - Enable customer innovation
  - Collaboration & consortia
- Geographic development
  - Focusing on high growth regions
  - Building Pall infrastructure and transferring knowledge
Collaborative & paid development programs

Development Programs have multiple phases

- Research & Modeling
- Field Evaluation
- Pre-commercial
- Commercial
Process & Application Development

Research / Modeling

• Minimum amounts of fluids required
• Cost effective method of evaluating technologies for a specific application
• Eliminates need for costly “Trial and Error” experiments
• Phase One Development Plan to assist in feasibility studies
• Provides budgetary information for pilot & commercial scale systems
• A skilled and experienced technical staff performs evaluation work and training of client staff
• Partner with Pall and receive expertise for process development
Collaborative & Paid Development Programs

- Field Evaluation system designs and purchase specifications can evolve from the data generated during research & modeling phase.
- Sizing can be prepared from Field Evaluation data for commercial scale installations.
- Pall experts are available for process consultation and continuously refine the model for commercial economics.
- Utility requirements can be predicted from the data generated during the program.
- All process development work is treated as “confidential”.
- Evaluation reports are scientifically supported.
Down selection begins Aug 2, 2011 – pilot plant designs are the goal
• Doug DiLillo – Joined Pall in 1995, 24 years in the industry
  – Phone: (516) 801-9423
  – Email: doug_dilillo@pall.com
• Global market lead – Industrial BioTechnology (IBT)
• Responsible for new business development and Pall technology positioning in the emerging IBT market space
• Promote Pall’s Industrial Sustainability goals by enabling technology solutions in the market space
Thank you for your attention

Pall's Total Fluid Management Process & Application Development Programs Provide Solutions to Industry Problems

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