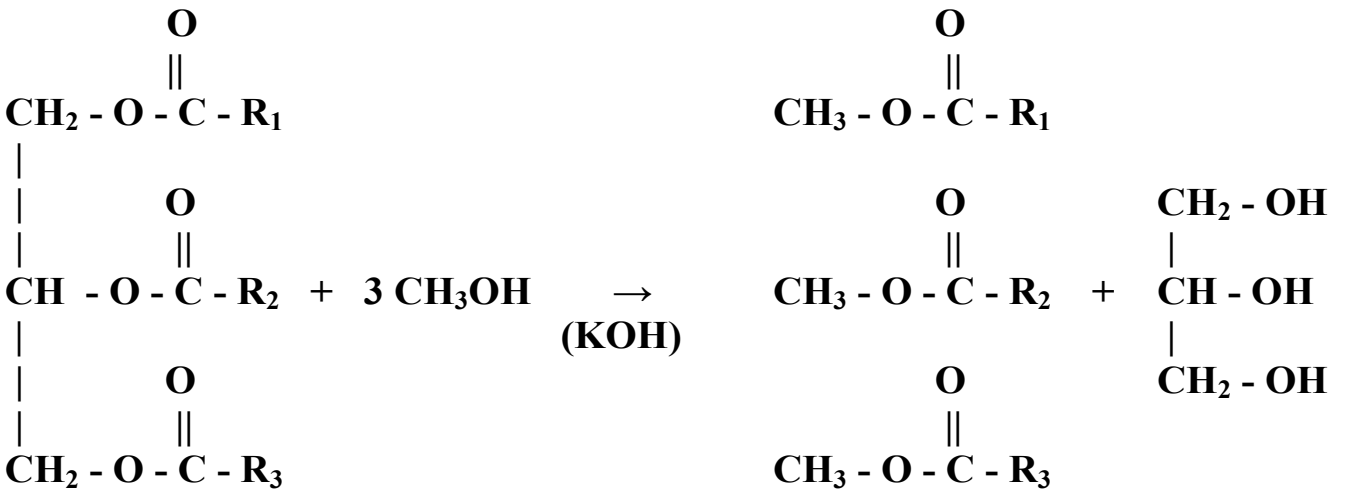
Strategic Biodiesel Decisions

What is Biodiesel?

- Biodiesel is defined as the mono-alkyl ester of fatty acids derived from vegetable oils or animal fats, commonly referred to as B100.
- Biodiesel must meet the specifications of ASTM D6751
- Biodiesel blends are a mixture of Biodiesel with petroleum diesel, commonly referred to as B20, B5, B2.

Transesterification



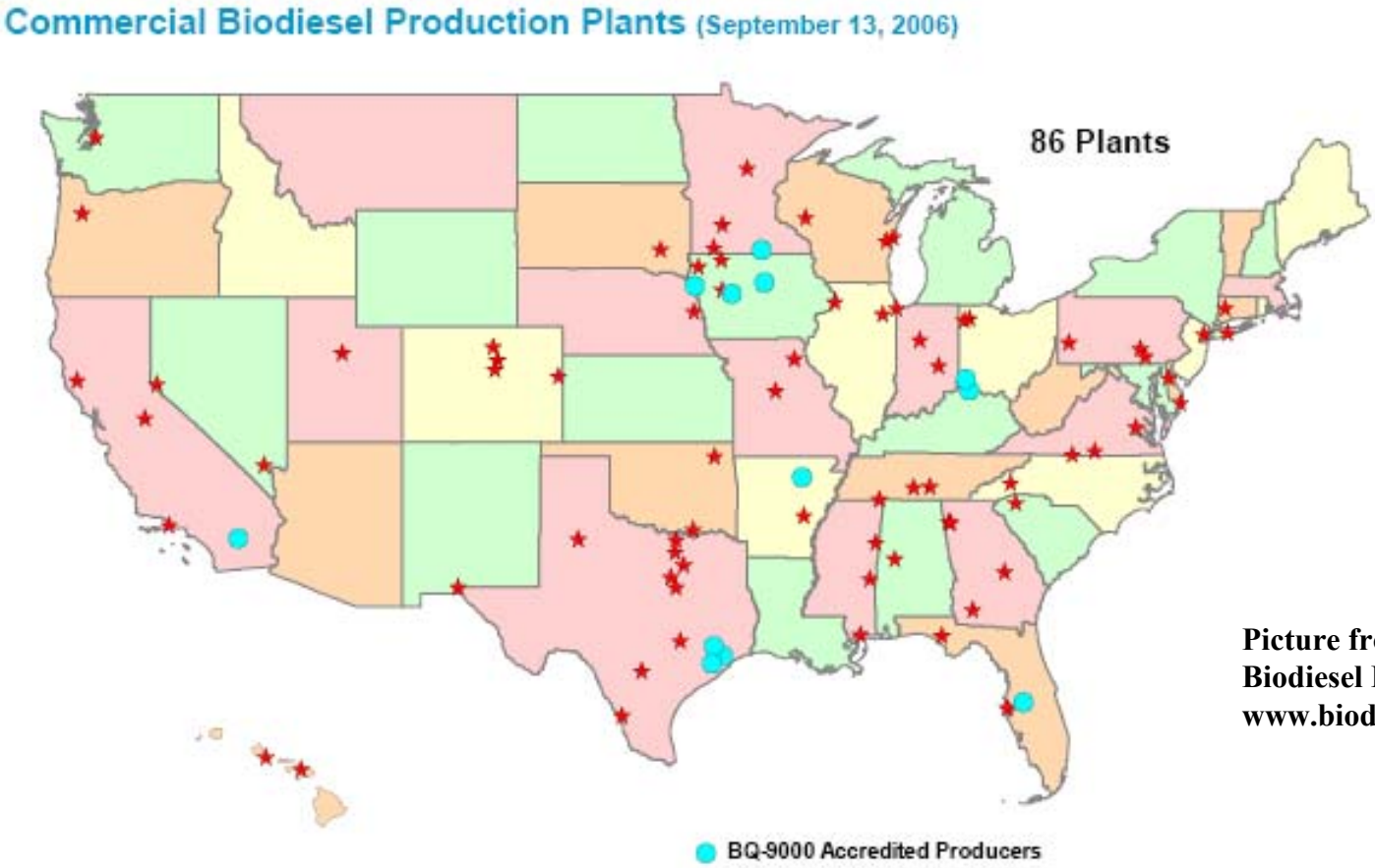
Standard Recipe

100 lb Oil + 21.71 lb Methanol →

100.45 lb Biodiesel + 10.40 lb Glycerol + 10.86 lb Excess Methanol

Plus 1 lb of NaOH catalyst

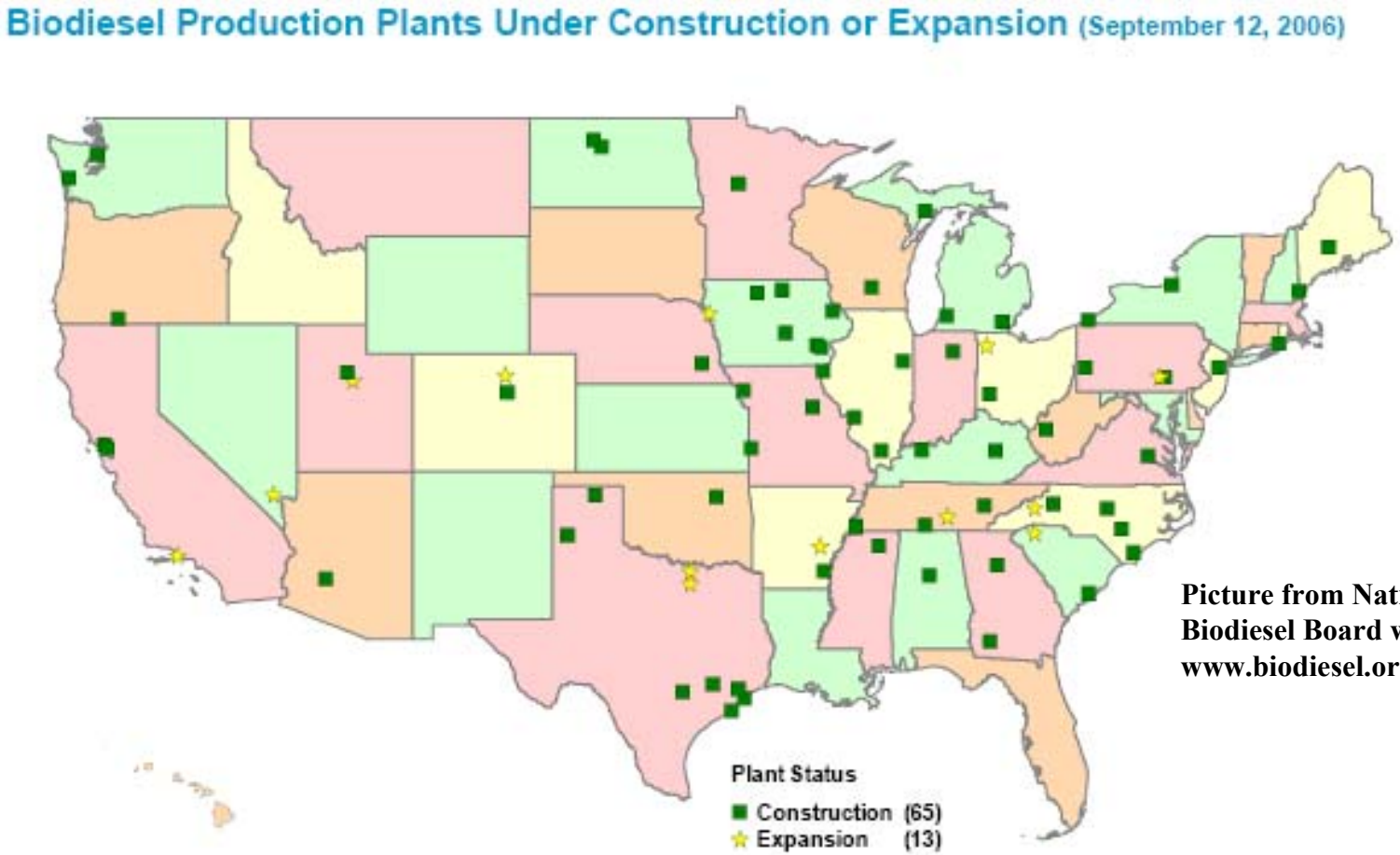
Biodiesel Production Capacity



Picture from National Biodiesel Board website www.biodiesel.org

Where you find solutions

Biodiesel Production Capacity



Picture from National Biodiesel Board website www.biodiesel.org

Biodiesel Production Capacity

- As of September 2006
  - 85 existing production facilities in US
  - Approximately 581 million gal/yr of capacity
- Proposed or planned plants
  - Estimated 1.4 billion gal/yr of capacity
- Total US estimated production capacity by mid 2007 is almost 2 billion gal/yr

Feedstock Supply

Current US feedstock supply

- 29 billion pounds of vegetable oil
- 12 billion pounds of animal fats
- 41 billion pounds of total feedstock per year

US Exports of feedstock

- 3.9 billion pounds of total exports
- Equals approximately 500 million gallons

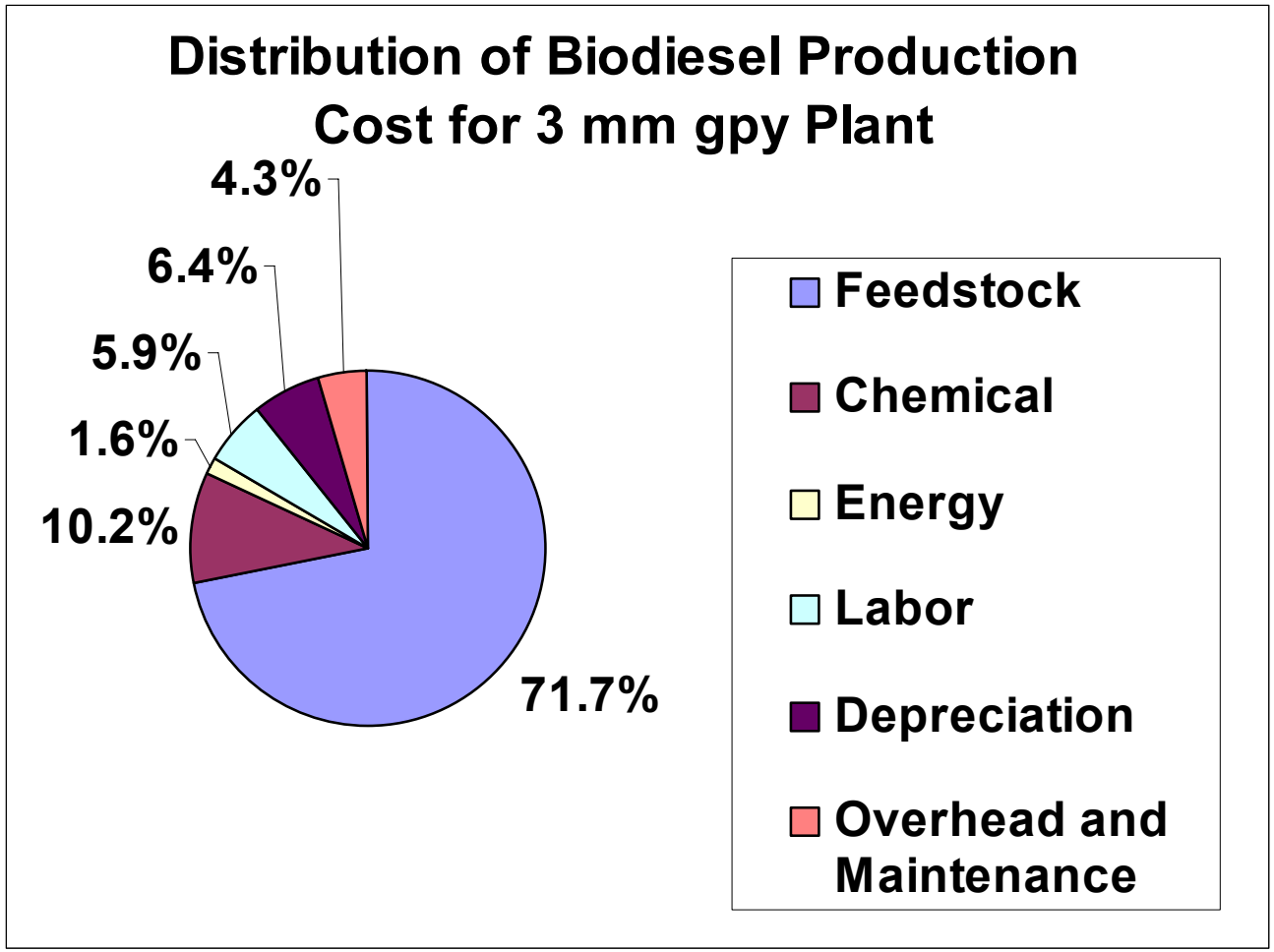
Feedstock Supply

- US Exports of feedstock
  - Of those exports, only 2.4 billion pounds are low enough in price to make biodiesel profitable
  - Will make 315 million gallons of biodiesel
  - Consist of soybean oil, palm oil, and a few rendered products

Feedstock Supply

- Supply and demand principle
- Meal constraint on additional crush
  - Ethanol industry
  - Export markets
- Competition with food industry
  - Cost differential with food grade
  - Oil is a small part of food product cost
- Oil imports

Why is Feedstock Price Important?



Feedstock Strategies

Which feedstock to use?

- Soybean oil
  - Price, lowest cost vegetable oil
  - Cold flow properties
  - Major seed crop in US
  - Local sources
  - Easy to use
  - No pretreatment

Feedstock Strategies

Which feedstock to use?

- Animal Fats
  - Lowest cost feedstock
  - Poor cold flow properties
  - Includes some second use oil
  - Rendered products
  - Possible odor concerns

Feedstock Strategies

Which feedstock to use?

- Determining factors
  - Plant location
  - Feedstock availability and price
  - Biodiesel properties desired
  - Competing biodiesel producers
  - Government incentives
  - Transportation logistics

Feedstock Strategies

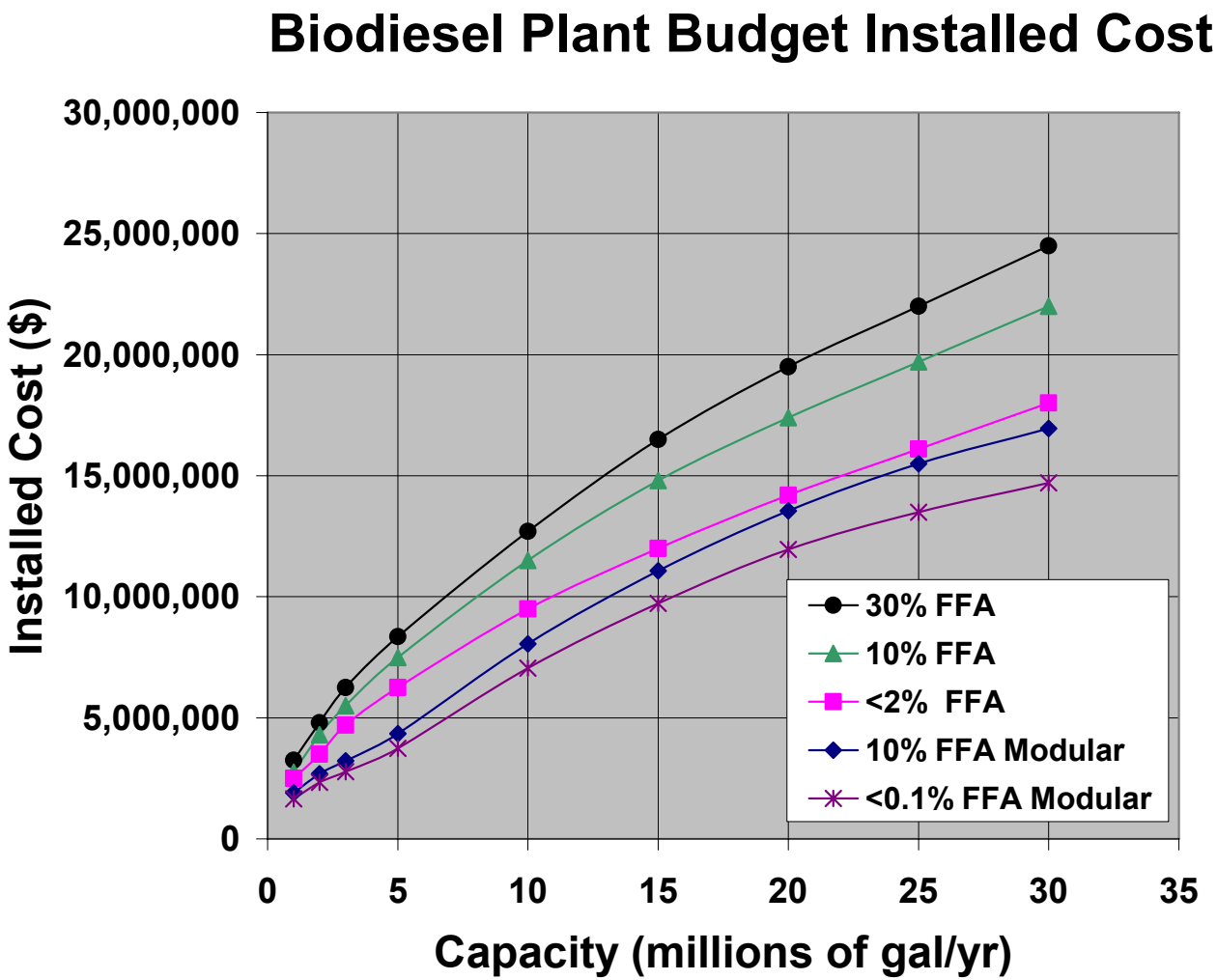
Which feedstock to use?

- Important considerations
  - Find feedstock sources early
  - Look for opportunity feedstocks
  - Develop a risk management policy
  - Design flexibility into your plant so that different feedstocks can be used
  - Do feedstock sensitivity calculations

Plant Cost

- Processing plant estimates vs. Complete plant estimates
- Installation Cost + Equipment Cost = Installed Cost
- Installation cost equals 1 ½ to 2 times the equipment cost
- New versus used equipment

Where you find solutions



Plant Size Considerations

- Batch plant cost less than a continuous plant
- Batch plant footprint is larger than continuous plant footprint
- Batch can be operated for short periods of time with out loosing efficiencies
- Continuous plant equipment must have the same flow rate or throughput
- Rule of thumb $1 per gallon of capacity

Plant Size Strategies

What plant size to build?

- Advantages of Large Plants
  - Large plant > 5 million gpy
  - Equipment cost per gallon produced are less as size increases
  - Operator expenses are usually less
  - Volume discounts on chemicals and feedstock
  - Transportation discounts for volume

Plant Size Strategies

What plant size to build?

- Advantages of Small Plants
  - Small plant < or = 5 million gpy
  - Smaller customer base needed
  - Less total feedstock required
  - Lower capital cost: Less capital investment
  - Can be a batch process
  - Capitalize on local and regional markets
  - Lower transportation cost: feedstock/products

Plant Size Strategies

What plant size to build?

- Determining factors
  - Market size and demand
  - Marketing abilities
  - Feedstock supplies
  - Site locations and infrastructure
  - Risk tolerance
  - Capital or financial resources

Plant Size Strategies

What plant size to build?

- Important considerations
  - Don’t discount local market loyalty
  - Don’t only look at the numbers
  - A large plant operating at less than capacity cost more to operate than a small plant running at capacity
  - The last million is always the hardest to raise

Plant Efficiencies and Capacities

- Operating at less than capacity means lower efficiencies therefore higher cost per gallon produced and possible lower quality
- A 30 mm gpy plant at 2/3 capacity is less profitable than a 5 mm gpy plant at capacity
- In order to operate at capacity, higher feedstock cost or lower selling price may be necessary – hence lower profits

Technology & Technology Providers

- Compare apples to apples
- Years in service
- Design vs. design with construction
- Partnership opportunities
- Work load and time line

Technology & Technology Providers

- Other services
  - Marketing assistance
  - Fund raising assistance
  - Management assistance
- Number of working plants
- Performance guarantees
- Environmental issues

Technology Strategies

Which technology is best?

- Continuous vs. Batch processing
- Solid catalyst vs. homogeneous catalyst
- Water wash vs. absorbent
- Feedstock pretreatment or soap removal

Technology Strategies

Which technology is best?

- Technology provider dependant
  - Knowledge level
  - Breadth of experience
- Turnkey vs. construction managed
- Skid mounted vs. site erected

Technology Strategies

Which technology is best?

- Determining factors
  - Feedstock consideration
  - Experience level of the technology provider
  - Ability to validate the technology
  - Size of plant to be built

Technology Strategies

Which technology is best?

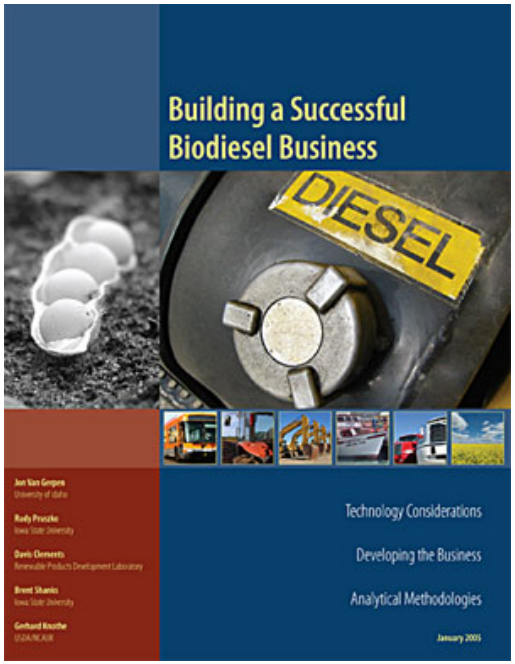
- Important considerations
  - Financial stability of technology provider
  - Is the technology proven?
  - Use technology providers knowledgeable in all facets of the plant
  - What is your expertise level?
  - Obtain references and visit a plant

Resources

- Biodiesel Workshop, material from the Biodiesel Production, Analytical, and Business workshops in Iowa and Idaho, 2006, http://www.me.iastate.edu/biodiesel
- National Biodiesel Board, http://www.biodiesel.org
- USDA
- CIRAS and Iowa State University

Where you find solutions

Resources



Rudy Pruszko, John Van Gerpen, Davis Clements, Brent Shanks, and Gerhard Knothe, *Building a Successful Biodiesel Business*, 2006, Iowa.

Available from

www.biodieselbasics.com

Where you find solutions

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