

# ***Business Perspective on Biofuels: Stages of Commercialization***

**Chris Rosen  
Haas School of Business**

**Please sit with your groups**

# **Today: Business Challenges**

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- **Today's class – commercialization of biofuels – stages and challenges**
  - **Overview**
  - **Amyris**
  - **Group exercise**

# **Business section of your course project**

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- **Announcement – handout on bspace**
  1. **Where is your sector in terms of development toward commercialization?**
  2. **Where is your sector in terms of funding?**
  3. **Your strategies for removing obstacles**
  - **Questions?**

# **Class plan for this section of course**

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- **Today - Technological and economic stages and challenges of commercialization**
- **Next Mon and Wed: funding opportunities and challenges**
  - Private sources available
    - Internal and external to your firms
  - Public sources of funding available
  - Challenges companies face trying to access

# **Class plan for this section of course**

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- **Following Monday 4/22**
  - Opportunities for businesses in your sector work to with each other and/or with other stakeholders to overcome some of the problems holding back commercialization of their biofuel technology?
    - On what public policy reforms?
    - On what voluntary initiatives?
    - How?

# Special class

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- **Next Wed: making the business case for funding biofuel development**
  - Guest speaker from BP (EBI): Craig Vaughn
  - Assignment/in class exercise:
    - Each group will develop a short PPT presentation for Craig (and me) putting forth the “business case” for a new round of funding for your project
      - We'll give you feedback

# Today

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- **Where are firms in your sector in stages of commercialization?**
- **What problems have they run into?**
  - What valleys of death have they crossed?
  - What are they struggling with?

# **Groups are dealing with three different kinds of firms**

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- **Biofuels start ups**
- **Large existing oil and chemicals firms with biofuels and bioenergy initiatives**
- **Public utilities**

**Stages similar**  
**Unique as well as similar problems**



# **Successful Commercialization: Aspirational Goals**

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- **Advanced biofuels (utilizing non-food biomass as feedstock) that are capable of gallon-for-gallon (or kWh-for-kWh) replacement of petroleum based fuels at comparable or lower cost**
- **Low or net zero GHG emissions**
- **Capable of using today's fuel and electric power distribution infrastructure and engine designs**
- **Safe for human and non-human life**

# Successful Commercialization

## KEY PRACTICAL GOAL

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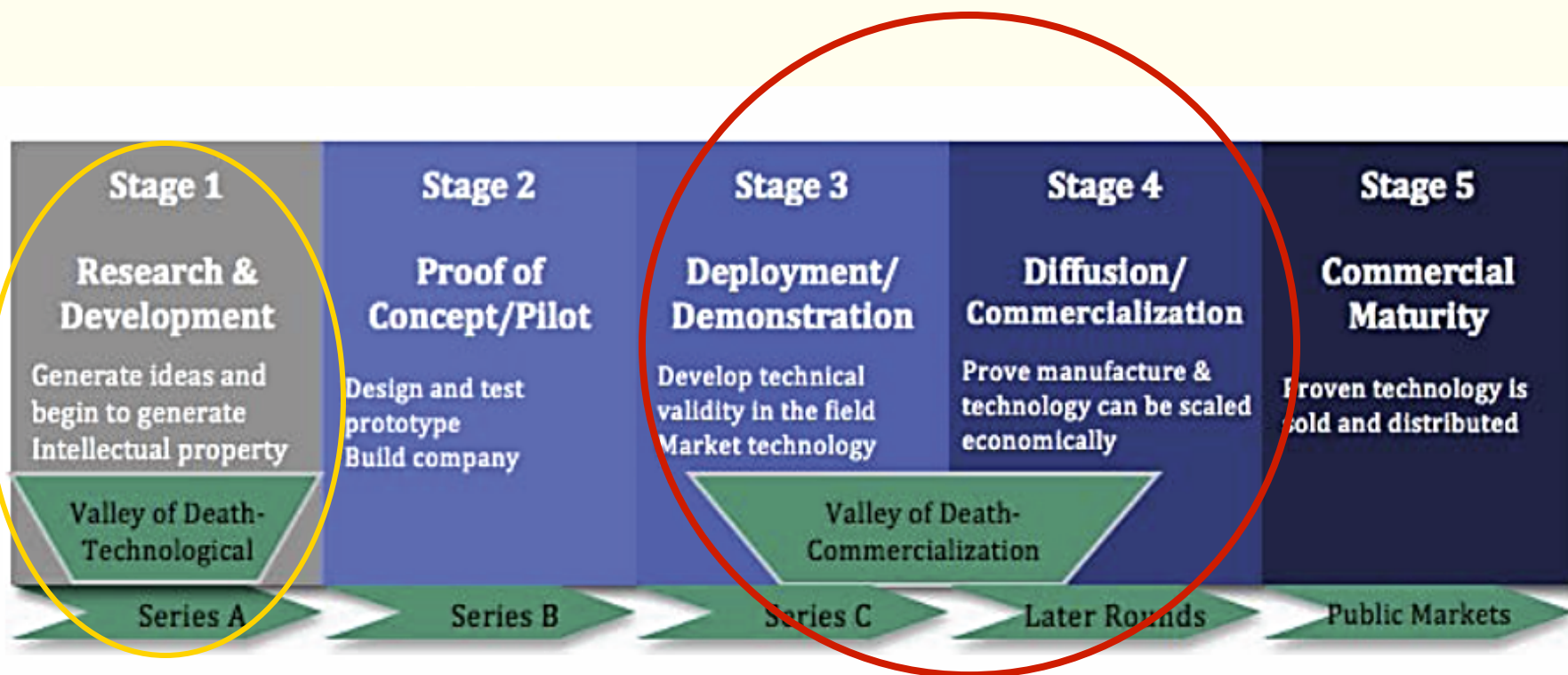
- **Financial sustainability!**
  - **Start ups:** Keep investors and lenders happy
  - **Initiatives within larger firms:** Keep top management on board
  - **Public Utilities:** Keep rate payers and PUC regulators happy

# OUR FOCUS TODAY

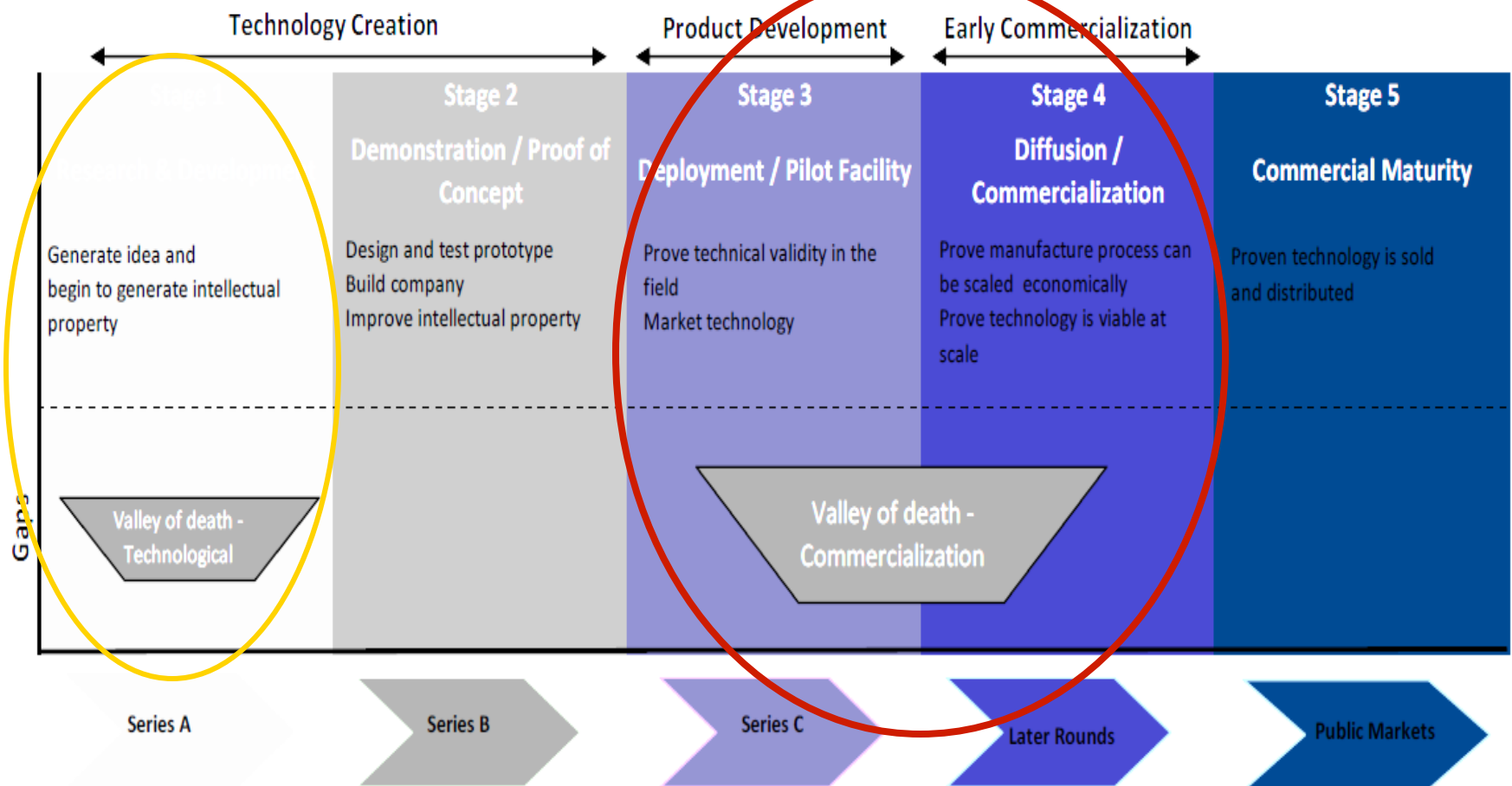
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- **Identifying where firms in your sector are in terms of stages of development toward successful commercialization of your biofuel or energy**
- **Understanding challenges firms face at each stage**
- **What it takes to bridge “valleys of death”**

# Stages of Development Valleys of Death



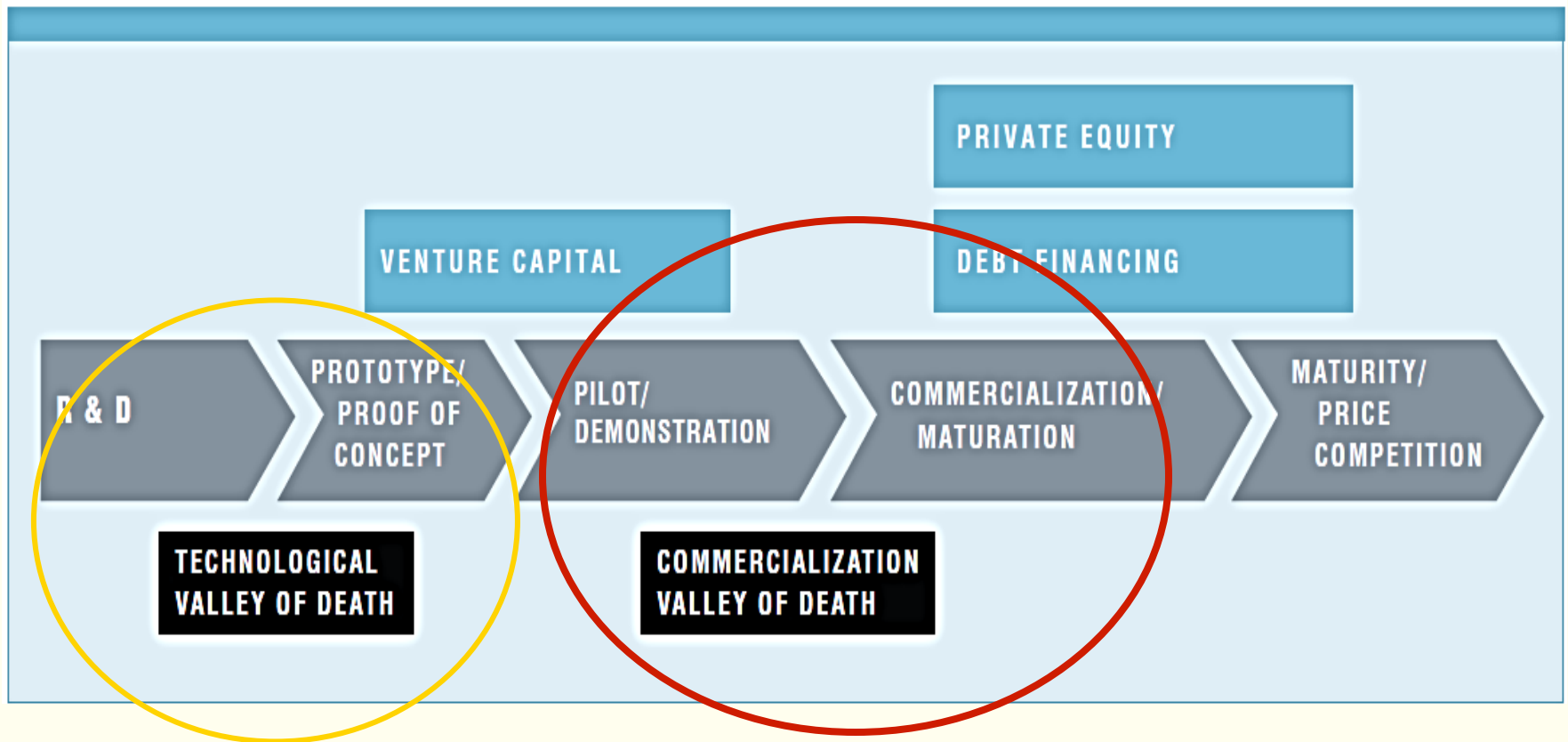
**Solecki et als, Advanced Biofuel Market Report 2012, p. 4**



**Bloomberg New Energy Finance, “Crossing the Valley of Death,”**  
**June 2010:** <https://www.bnef.com/WhitePapers/download/29>

Figure 1

## THE ENERGY INNOVATION CYCLE AND THE CLEAN ENERGY VALLEYS OF DEATH



# ALL Valleys of Death Are Complex

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- **Early “tech” valley**
  - Great ideas run into problems at basic R&D/  
proof of concept stage
- **Later “commercialization” valleys**
  - **Scaling up problems**
    - Technological
    - Siting, construction etc.
  - **Regulatory problems**
  - **Supply chain problems**
  - **Internal management/organizational problems**
  - **“Other”**

# **Financial problems huge**

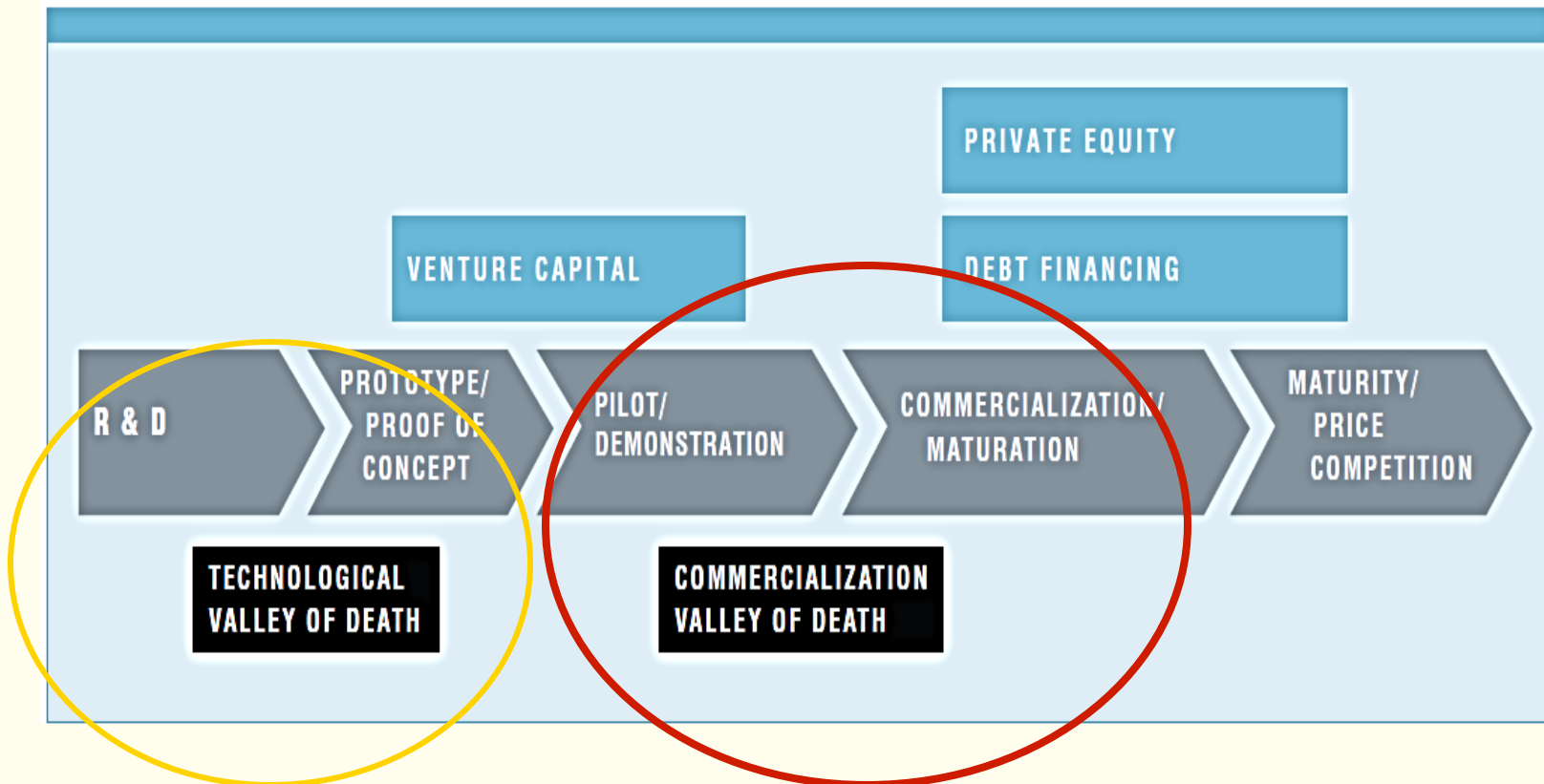
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- **Funding gaps at every stage**
  - Failure to meet cost goals
  - Failure to meet timeline goals
- underestimate costs – cost overruns



Figure 1

## THE ENERGY INNOVATION CYCLE AND THE CLEAN ENERGY VALLEYS OF DEATH



Jenkins & Mansur, **Bridging the Clean Energy Valley of Death** (2011), p. 5

# **Today:**

## **Group Project research**

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- **Where is your sector in terms of development toward commercialization?**
  - 1. At what stages of the development process (pilot, demonstration, full commercialization) are existing businesses producing your biofuel technology currently in?**
  - 2. What kinds of technical, economic, and other problems are firms running into at each stage that you found? How serious are these problems?**

**At least 3 companies minimum – ideally more – see if you can find cos in different stages**

# **Today:**

## **Amyris case**

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- **Amyris's business**
- **Its early development**
- **Short group discussion:**
  - How would you characterize the main technical problems Amyris faced and breakthroughs it experienced at
    - Pilot plant stage
    - Demonstration plant stage
    - Commercial plant stage
- **What has happened since 2010?**

# On line information sources doc on B-space

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- **Company websites**
- **Search for Energy:** <http://www.aeoogle.com/>
- **BiofuelsDigest:**  
<http://www.biofuelsdigest.com/bdigest/>
- **Biomass Magazine:** <http://biomassmagazine.com/>
- **Renewable Energy.world.com:**  
<http://www.renewableenergyworld.com/rea/tech/bioenergy>
- **Biofuels Journal:** <http://www.biofuelsjournal.com/>
- **Renewable Chemicals Digest:**  
<http://www.biofuelsdigest.com/biotech/>
- **Google search** (general, books, and/or scholar)

# Other sources

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- **Long Library (business library)**
  - **Factiva search engine**
    - Go to <http://www.lib.berkeley.edu/BUSI/>
    - Click on Digital Business Library – Data Bases by Subject – scroll down to **Factiva** (under “best sources for business news, press releases, & transcripts”)
  - Other Haas funded sources (Datastream, Frost & Sullivan etc.)
- **Interviews with parties at your companies and other experts**

# “Amyris biofuels”

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- **Google – “Amyris biofuels”**  
**<http://www.technologyreview.com/view/426866/amyris-gives-up-making-biofuels-update/>**
- **Aeoogole - <http://www.aeoogole.com/>**
- **Biofuels digest**  
**<http://www.biofuelsdigest.com/>**