



Nanotech Opportunities / Challenges

Nanotech opens doors to revolutionary opportunities enabled by the properties of materials at the nano scale.

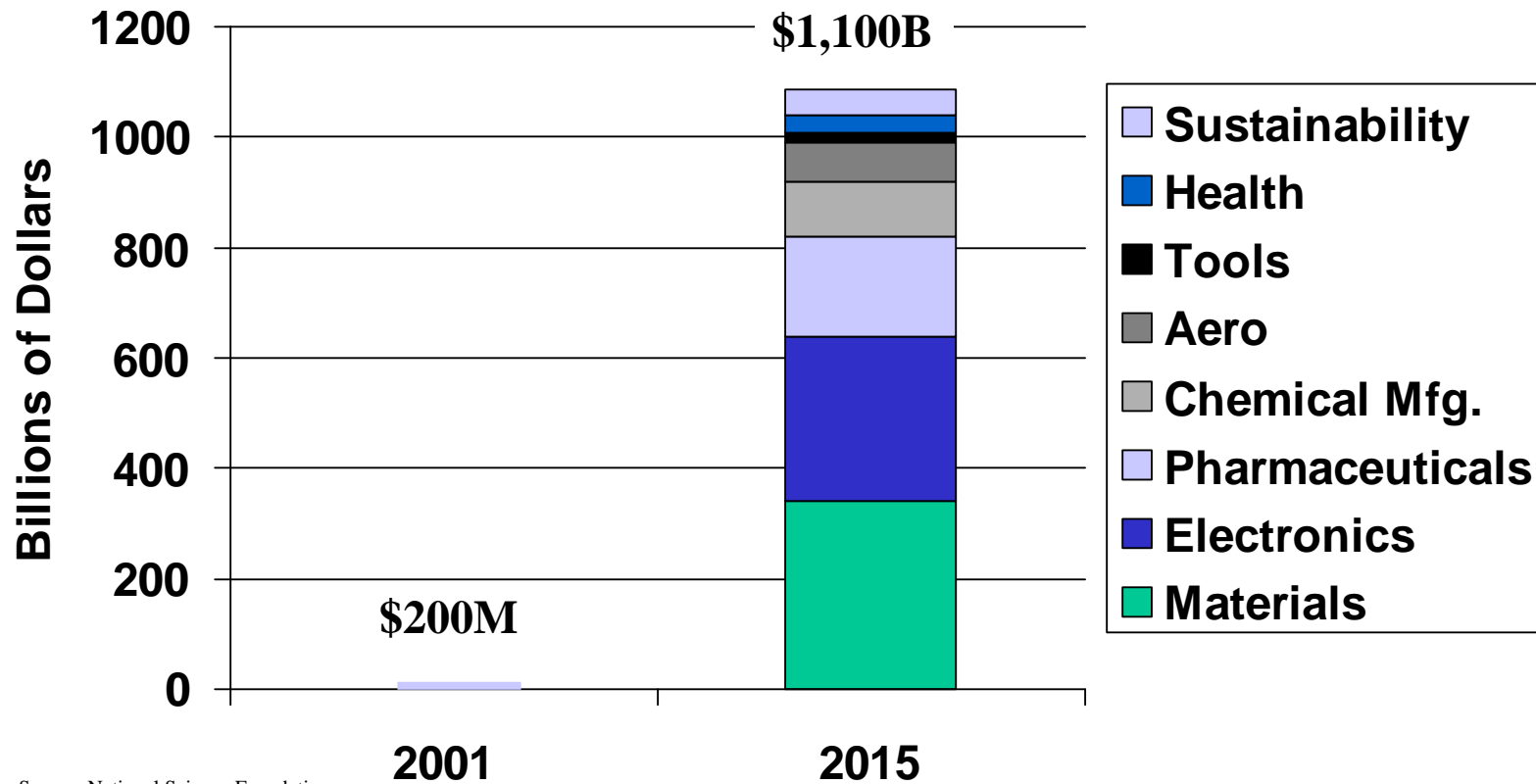
Commercializing nanotech provides great challenges requiring cross-disciplinary teams.

This is the Nanotech Century!



Nano's Big Impact

Standard forecast but too hard to call



Source: National Science Foundation



Trends - GDP & Employment

- Mid 1800s most people worked on farms
- In 2005 < 2% of people work on farms

Productivity and Automation changed that

- Mid 1900s most people worked in factories

Productivity and Automation changed that

- Since 2000 US lost ~ 2M manufacturing jobs
- Since 2000 World lost ~ 22M manufacturing jobs
 - Trend likely to continue
- High skilled knowledge work is dominating

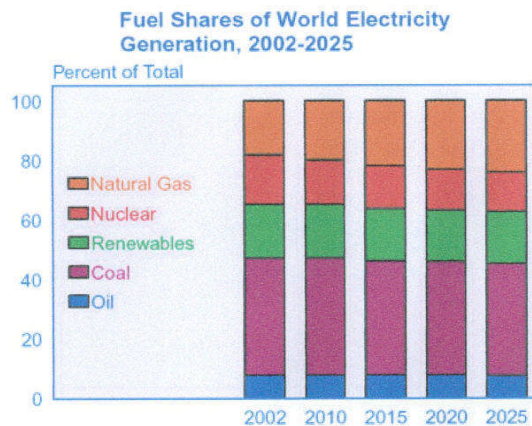
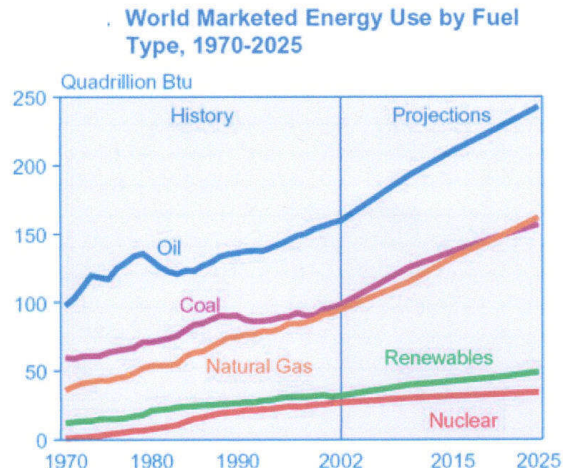
Nano builds on RECENT knowledge

Education & Re-education essential



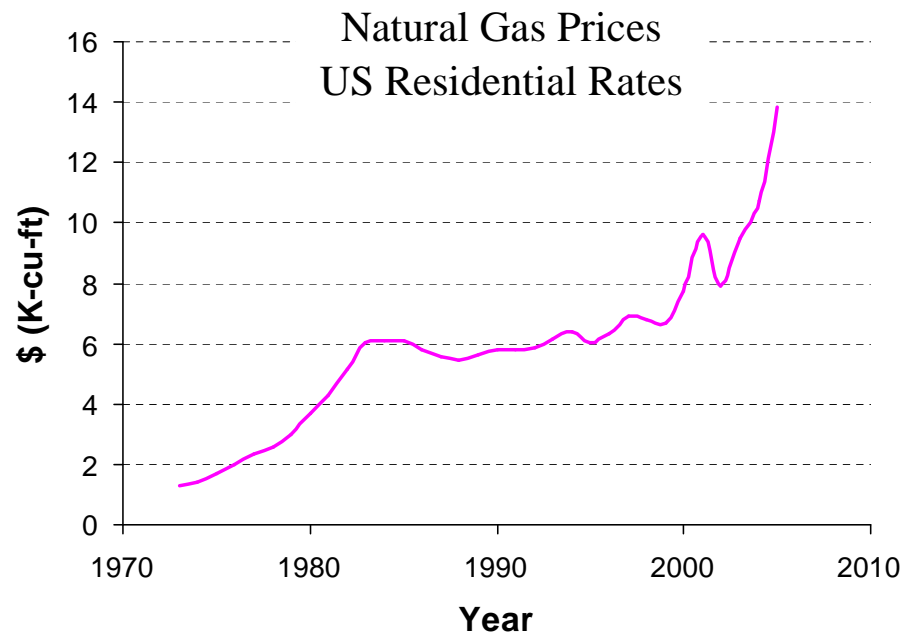
Trend - Energy Price

- Developing Country Demand Driving Energy Prices



Sources: **2002:** Energy Information Administration (EIA), *International Energy Annual 2002*, DOE/EIA-0219(2002) (Washington, DC, March 2004), web site www.eia.doe.gov/iea/. **Projections:** EIA, *System for the Analysis of Global Energy Markets* (2005).

- Price drives most users to carbon fuels
- Coal is cheap and plentiful
- Oil works in transportation
- Natural gas is cleaner but still carbon

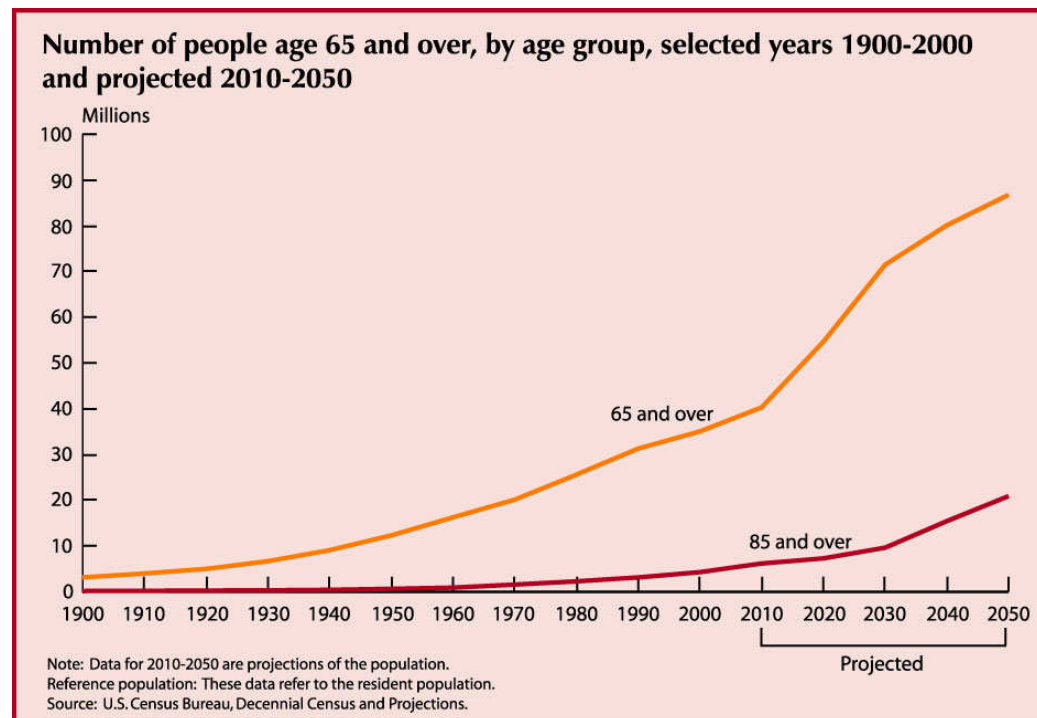


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Trend - Aging Population

- US population of elderly is growing in numbers but also as a **% of total population**
- Many countries have similar demographics - **even China**
- **Medical advances may exacerbate these demographics** beyond current projections

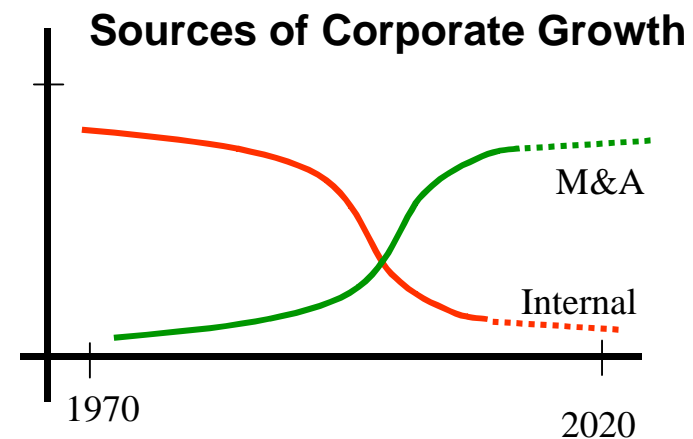
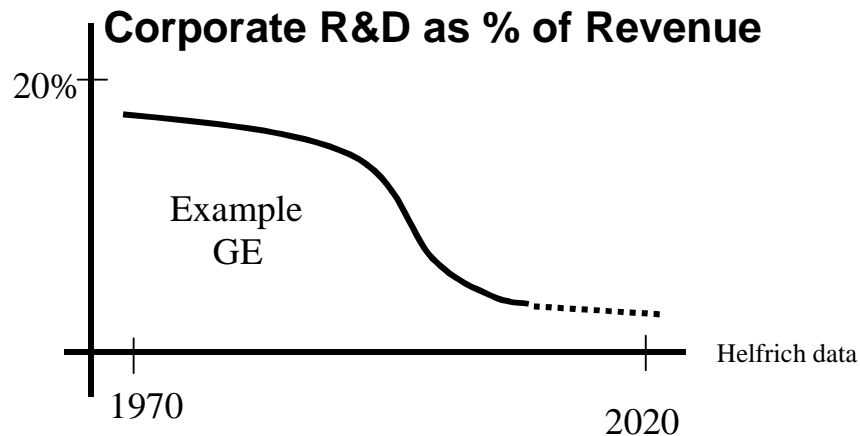




Startup Opportunity Drivers

- Global economic conditions, financial markets, global competition, and accelerating technology itself have altered where and how most advances occur.
- Enterprises no longer produce most revolutionary advances internally but instead acquire companies.

Never have conditions for technology and life science startups been as attractive relative to enterprises.





Tougher Funding Environment

- Many venture funds still support a large startup portfolio from 1998-2000.
- Early stage funding is at a 10-year low * as percent of total venture funding.
- Nanotech is generally viewed as excessively long-term by most venture funds †.
- Startups should plan on achieving key milestones before seeking VC funding.

* Thomson Venture Economics, PwC and NVCA.

† Some nanotech systems may take several decades to reach markets, but some could reach markets in just a few years.



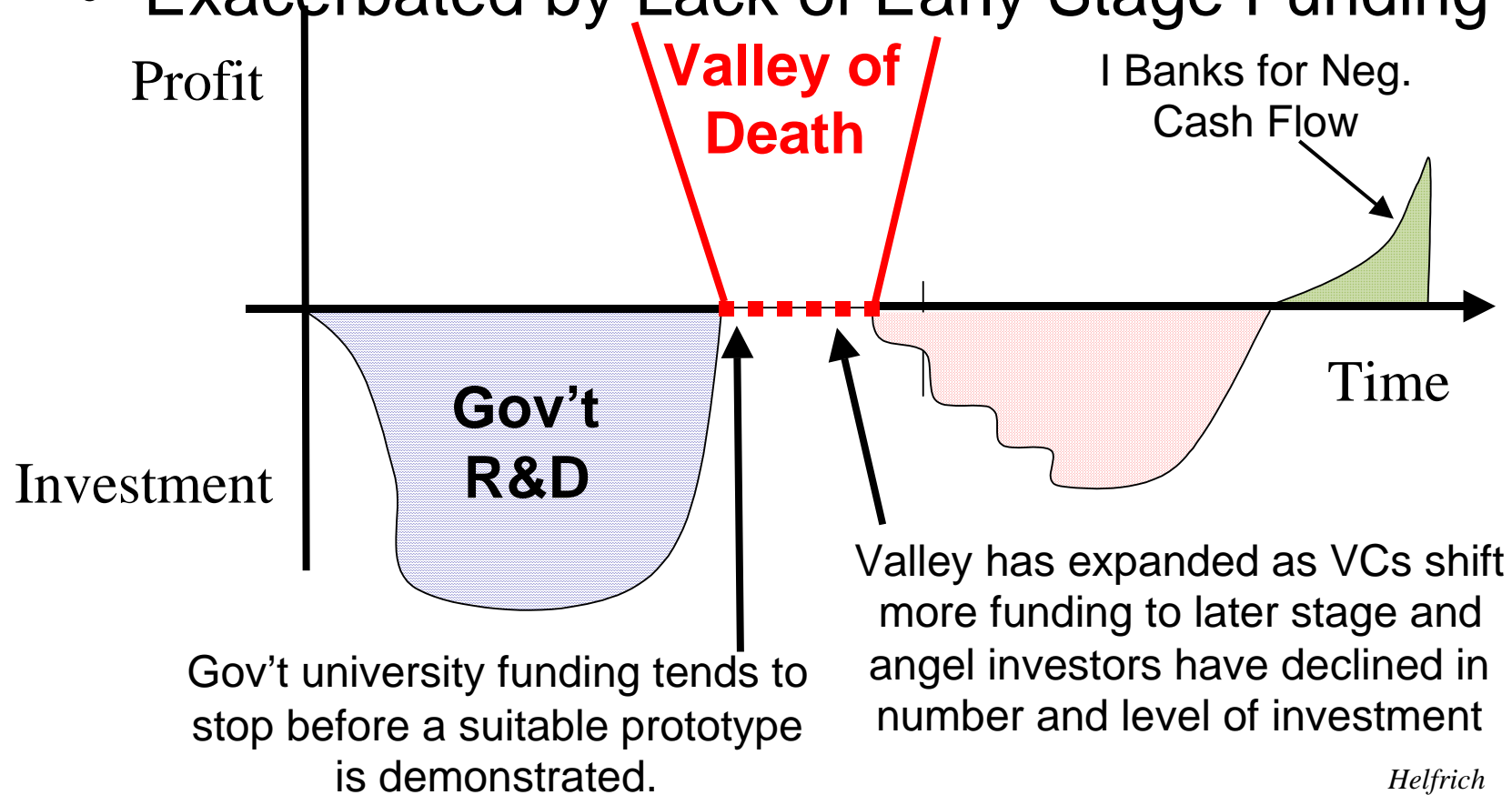
VC Requirements to Fund Startups

- **Disruptive** technology
- Top technology **team** - some management
- **Proof of concept** - not just proof of principle
- Defensible **intellectual property**
- **Customer** references
- Viable **business model**
- Substantial **revenue** likely
- Reasonable **total capital** to exit
- **Syndicate** able to carry startup to exit
- Acceptable **IRR adjusted for risk** - payback to investors = many times invested \$



Commercialization Gap

- Valley of Death Expands for Complex Tech
- Exacerbated by Lack of Early Stage Funding





Nano Myths and Reality

Issue A - Nano takes longer to a good exit

- Most nano is early so yes on average - BUT

Issue B - Nano IP is too complicated

- Patents have some value but are not the only answer
- Proprietary Know-how can be more defensible
 - But know-how is hard to prove unique to one startup

Issue C - Nano is hardest to make profitable

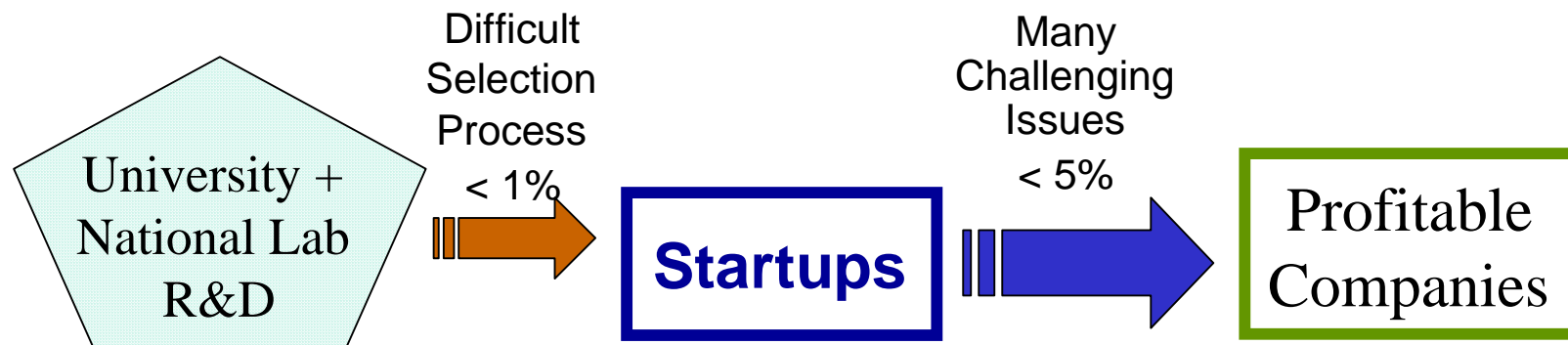
- It depends - picking first product is key to success
- Avoid waiting until best version is complete - sell
- Nano margins tend to be better - products harder to copycat on average



Sources of Nanotech Opportunities

Convert R&D to Profitable Companies

- Much of the \$ spent on R&D (outside of DoD) are spent at Universities and National Labs
- Few enterprises are now equipped to take advantage of this early stage R&D.
- Few startups result from these sources and many more should but lack one or more elements.
- Success requires startups with teams, relationships and skills to create winning companies.



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Where Does Nano Fit in Markets

Nanotechnology markets - ranges of timelines & suitability to startups

Technology Markets	Devices	Tools	Materials and Molecules	Models & Simulations
Information Technology	MEMS, FPDs, modified semiconductors, sensors, plastic electronics, nanotubes	STM, MEMS, lithography, MBE, AFM, ALD, NMR	Plastic electronics, nanofilms for data, optics, nanotubes, nanowires, cooling , +	Quantum Scale Simulations
Life Sciences	Medical implants, drug delivery, surgical instruments	STM, MBE, AFM, NMR/ MRI	Pharma production, artificial kidney/liver, targeted therapeutics , medical implants, organ regeneration	Bio-simulations, drug discovery, acceleration of trials
Energy / Environment	Organic solar cells, nano solar cells, sensors, fuel cells	STM, lithography, MBE, AFM, NMR	Enzymes, Catalysts , Solar Absorbers + coatings, Medical implants, membranes	Weather & Global Warming
Industrial	Wear/failure sensors, wireless sensors, other sensors	STM, lithography, MBE, AFM, NMR	Thermal dissipation, wear reduction, electro-chromic paints & glass , window materials, +++	Nanostructure design

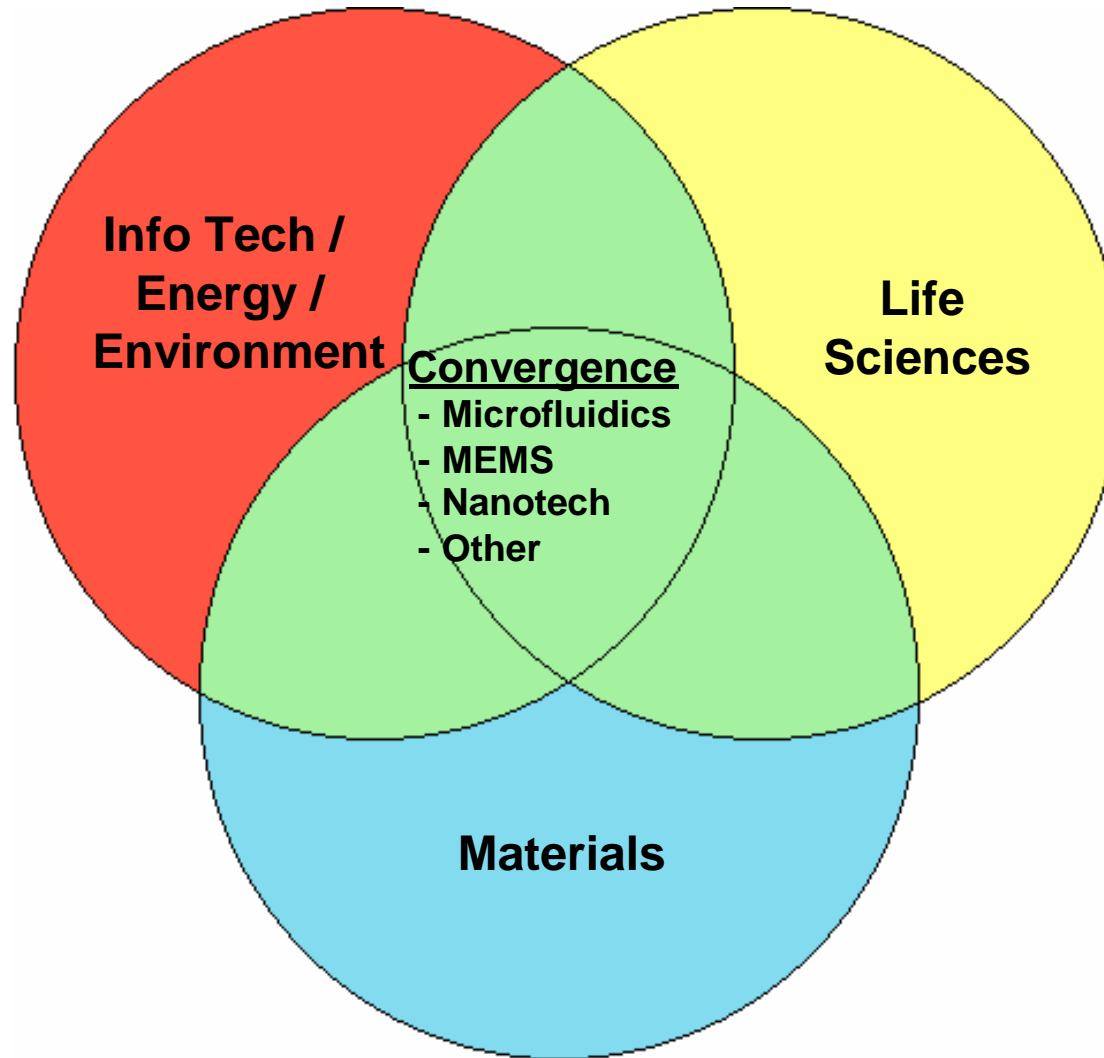
Legend Suitable Early Stage [Very Long Term]

Not for VCs

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Leading Sectors of Nanotech Opportunities





Great Nano Market Opportunities



What happens between now and 2105 is harder to predict

Politics has become a key driver

- Energy Generation
 - Nuclear Fusion - large powerplants
 - **Solar, Wind and Direct Bioconversion**
- Energy Storage - Conversion
 - **Fuel Cells** & **Capacitors?** & ?
- Nanomanufacturing
 - **Nano catalysts & assembly**
- Water Purification from Seawater
 - **Nano-membranes**
- Medical Therapeutics
 - Embryo DNA mod prevents disease
 - **Replacement organs** thru stem cells
- Medical Devices/Equipment
 - **DNA Diagnostics and Treatment**
- Communications
 - **>10 Gbps stationary & 100 Mbps mobile**



Energy Chain - Nano Opportunity

Sources → Store-Convert → Consume

Greenhouse gas emitters - CO₂

- Natural gas
- Oil - gasoline
- Coal

No greenhouse gas emission

- Nuclear
- Hydro
- Wind ←
- Solar
- Biomass
- Fusion

Advanced Batteries

- Less weight-size

Super Capacitors

- Less weight-size

Thermal Engines

- Higher Efficiency

Fuel Cells

- Efficiency
- Price
- Reliability
- Transport

Ideal with H₂ from water

Efficient Lighting

- several

Efficient HVAC

- Direct air

Efficient Motion

- Higher temp
- Less friction
- Less mass

Efficient Electronics

- Less heat gen

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Selected Opportunities

- NanoBio - Using nano to enhance biology
 - **Systems** for inexpensive/fast disease diagnosis
 - Devices for disease **treatment & management**
 - Molecules and organisms to **correct** environmental problems
 - **Targeted** delivery of therapeutic agents - new or existing
 - **DNA customized** therapeutic agents
- Nano-devices/molecules - Enhanced w/ nano
 - Wireless sensor systems for **environmental monitoring**
 - **Competitive systems** for solar energy **without subsidies**
 - Fuel cell **systems** competitive to gas/oil **without subsidies**
 - Nano membranes for **efficient water cleaning**.
 - Building, machinery and people **health monitoring** sensors
 - Plastic electronics to provide **affordable** uses for everyone
 - UWB devices for **affordable** **high density & data-rate**



Nanotech Conclusion

ALAMEDA
CAPITAL

- 1 - **Nanotech provides endless opportunities** for entrepreneurs seeking to change the world and generate wealth.
- 2 - **Focus on learning** as much as possible in one field and develop modest understanding of other fields.
- 3 - **Choose your opportunity wisely** based on skill set, market need, barriers to entry, technology maturity, etc.
- 4 - Devise plans to move along as far as practical **without venture funding - SBIRs, Grants, Contracts, Customers, and F³**

**Create / Collaborate /
Commercialize!**



For More Information

- www.alameda.com, Alameda Capital
- www.nano.gov, NNI site
- www.blueribbonnano.org, California Blue Ribbon Task Force on Nanotechnology
- www.sbirworld.gov, listing of many federal R&D grant opportunities from all 11 SBIR/STTR agencies
- www.grants.gov, listing of grant programs from 26 federal agencies
- <http://g-jgreenwood.home.att.net/SBIR.htm>, award winning training group for SBIR proposals

- rich@alamedavc.com