Innovation, Protection and Transfer of Green Technologies

imagination at work

Green Technology Innovation

Basis Principles of Green Tech IP Ecosystem

- Without innovation there is no technology to transfer
- Without investment there is no innovation
- Private investment capital chases the highest and most predictable return on investment (ROI)
- If IP protection for green tech IP is weakened, innovation capital will be diverted elsewhere
- There are always other options, especially when green technology markets depend on government subsidies

Green Technology Innovation

Do We Need More Green Tech Innovation

- The secretariat UNFCCC estimates that an **additional $200 billion** in global investment and financial flows will be required annually by 2030 just to return GHG emissions to current levels.
- Clean R&D spending today is **less than about 1/2** that amount
- The Private Sector pays for **70% of Global R&D** and **over 80% of Clean Energy R&D**

Private Investment is Essential for Long-Term Climate Change Solutions

What is the Role of Innovation

Why is Green Tech Innovation so Important?

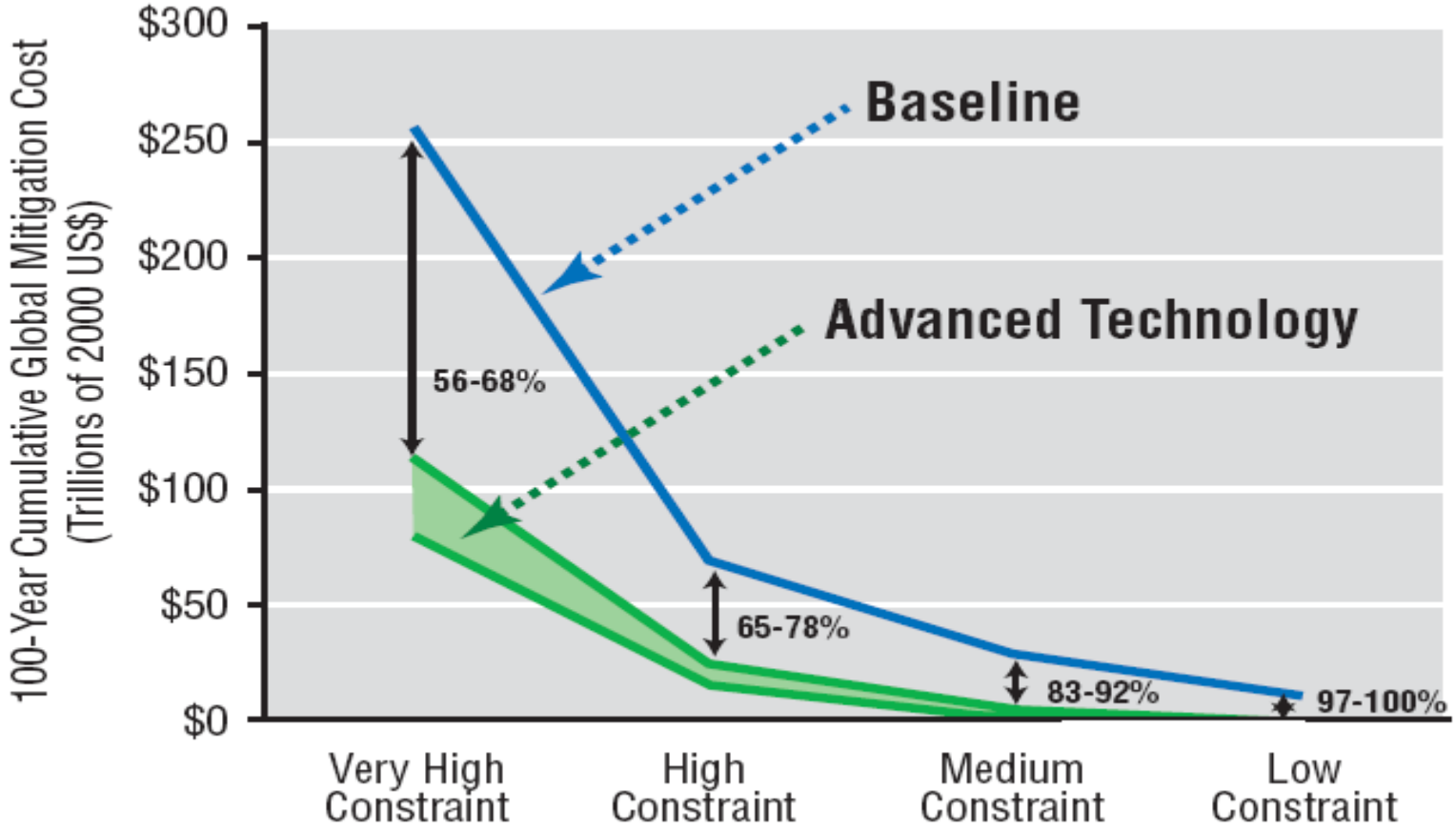
One study finds that if we were limited to technologies available in 2005, the present value cost of achieving stabilization at 550 ppm CO_2 would be over **$20 trillion greater** than with expected developments in energy efficiency, hydrogen energy technologies, advanced bio-energy, and wind and solar technologies (Edmonds 2007).

Other studies have found that accelerated technology development offers the potential to **dramatically reduce the costs of stabilization**, with advanced technology scenarios reducing the cumulative costs of stabilization by **50% or more**, yielding economic benefits of **hundreds of billions to trillions of dollars globally**.

Only Innovation Can Make Climate Change Solutions

Estimated 100-Year Potential Cost Reductions

Comparative analysis of estimated cumulative costs over the 21st century of GHG mitigation, with and without advanced technology, across a range of hypothesized GHG emissions constraints.



How Is Green Tech IP Different

Green Technology IP is NOT like Pharmaceuticals

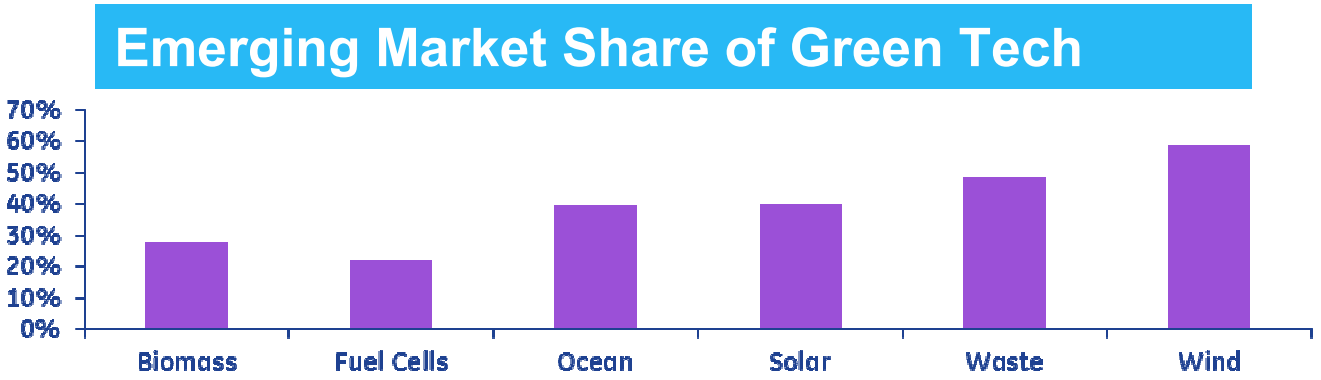
- No single patent can block an entire technology
- Basic technology has been off patent for years if not decades
- Patented technology provides only incremental improvements
- Most incremental improvements can be designed around
- For most clean products – cost is in labor & materials (not IP)
- Pricing for Green Technology products is competitive

  e.g., > 20 wind competitors and > 45 solar companies
- Complicated products carry more trade secret technology (not patent protection). . . Difficult to “force” such transfer

Lessons & Frustrations from Pharma Should NOT Taint Green

Green Technology Patent Trends

- Climate inventions represent ~1% of inventions world-wide
- 2/3 clean tech patents are concentrated in JP, DE and US
- China, South Korea, & Russia have 15% of climate patents
- Emerging economies own a significant % of patents within their markets and it is growing very rapidly. . . China is leading that trend
  - In 1994-1998 BRIC accounted for 3.75% of patents on clean technology
  - In 2008, BRIC accounted for 20.5% of patents on clean technology



Most Common Mitigation & Adaptation Tech

Energy	Industry	Transport	Agriculture, Forestry, Waste
• Renewables	• Industrial Energy Efficiency	• Vehicles (Motor/Bus)	• Forestry
• Combined Heat/Power	• Boilers	• Rail	• Crop Mgmt
• Demand Side Mgmt	• Cement Production	• Facilities	• Water purification
• GTCC	• High Eff. Motors	• Freight	• Irrigation
• Combustion turbine	• Steel		• Land Mgmt
• Coal	• Furnaces		• Livestock Methane Capt
• Legacy Improvements	• Mining		• Pest Mgmt
• Energy efficient appliances	• Fuel Switching		• Fishery
• Green bldg materials & design	• Aluminum		• Water recycling
• Direct heating	• Lighting		
• Municipal Heating/Water			

Driving Forces & Barriers

Driving Forces Shaping Environment

Perception of “the problem”

Pace of technology development

Ability to serve current market needs

Economic incentives

Government Incentives
- Grants or other funding
- Tax incentives
- Tax penalties
- Government as consumer

Ability to adopt new technology
- Current infrastructure (+/-)
- Desired pace of change

Changes in governing rules of law

Concerns over reputation

Barriers to Successful Tech Transfer

Not enough technology to transfer

Inadequate economic incentives
- No/low profit from investments
- No/low tax incentives

Insufficient or inadequate systems supporting technology transfer
- Existing infrastructure
- Manufacturing capabilities
- Sourcing capabilities

Inadequate laws governing transfer
- No/weak IP protection
- Little ability to punish violators
- Perceived inability to control one’s destiny in a given jurisdiction

No credit for “doing the right thing”

IP Helps Drive VC Funded Innovation

A123 SYSTEMS

EV/Hybrid Batteries

Soliant

Solar

advanced electron beams

Water free sterilizatio n

ORION

Lighting & Energy Mgmt

cirisenergy

Biological conversion of coal

GE is a unique venture capital partner …

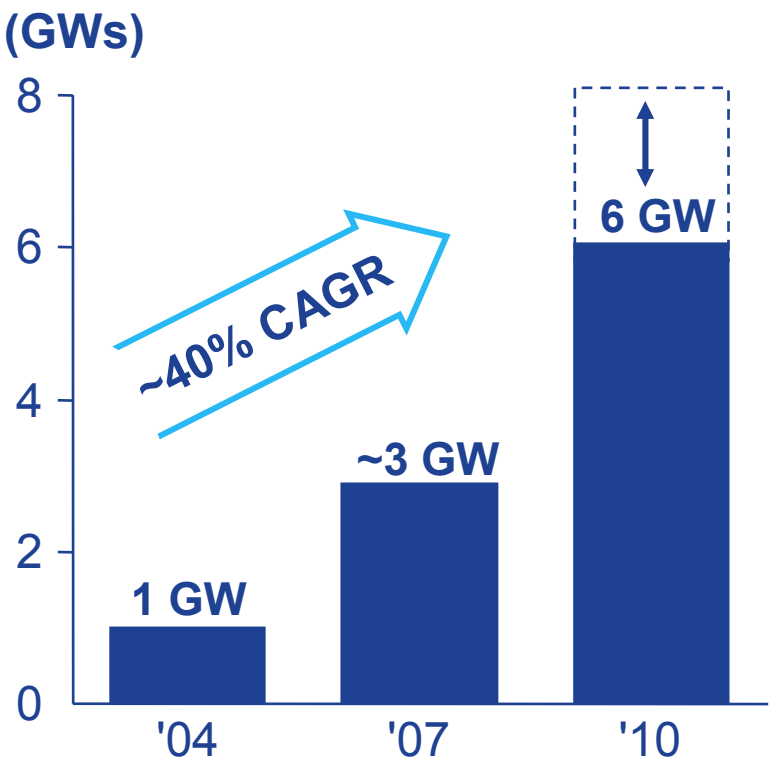
~ 40,000 technologists

~ 45,000 sales/marketing

Intellectual Property is an ACTIONABLE Property Right

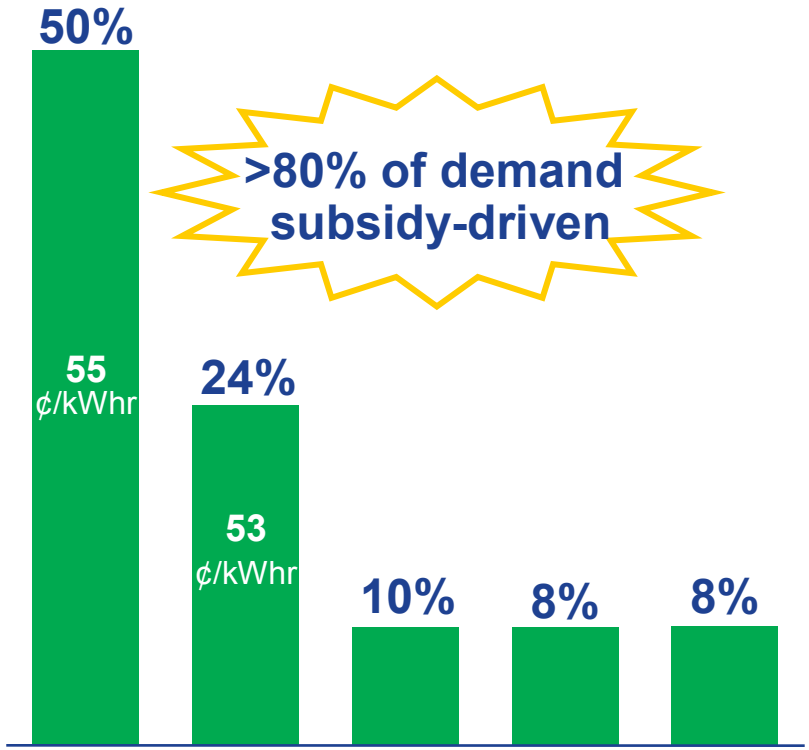
Solar … fastest growing renewable

Industry installation forecast



Source: Navigant Consulting 2007

2007 regional installs



Source: Solarbuzz 2008

Growing segment … incentive driven

Multiple Solar Technologies Emerging

	2008 Install Base	Efficiency Today	COE (c/kWh)	COE W/ ITC	Tech Maturity	*Pros & Cons*
 Crystalline Silicon	~8GW	12-14%	~30c	~18c	High	Established technology; Large volume avail; Abundant raw materials Slow cost reductions based on maturity of industry
 Concentratin g Solar Power	~0.5GW	??	~23c	~15c	High	Lower cost than Crystalline Silicon, designed for utility scale Limited cost upside; Water required; Geographic limitations (desert only)
 Thin Film Silicon	~0.6GW	6-8%	~22c	~13c	Med	lower cost than Crystalline Silicon; Leverages LCD display industry Lower efficiency, high CapEx
 Thin Film CdTe	~0.7GW	9-11%	~19c	~11c	Med	Lowest cost module technology, higher capacity factor – better in diffuse light Currently low availability
 Thin Film CIGS	<0.1GW	8-9%	~27c	~16c	Low	Low cost potential; light weight solution, BIPV friendly No practical encapsulation solution yet (lifetime/reliability)
 "Gen III"	0	1-5%	NA	NA	Very Low	Potential to be lowest cost solution High risk, pure R&D required