



Growing your Business in the Green Economy
Clean Energy Connections Conference

October 20, 2010

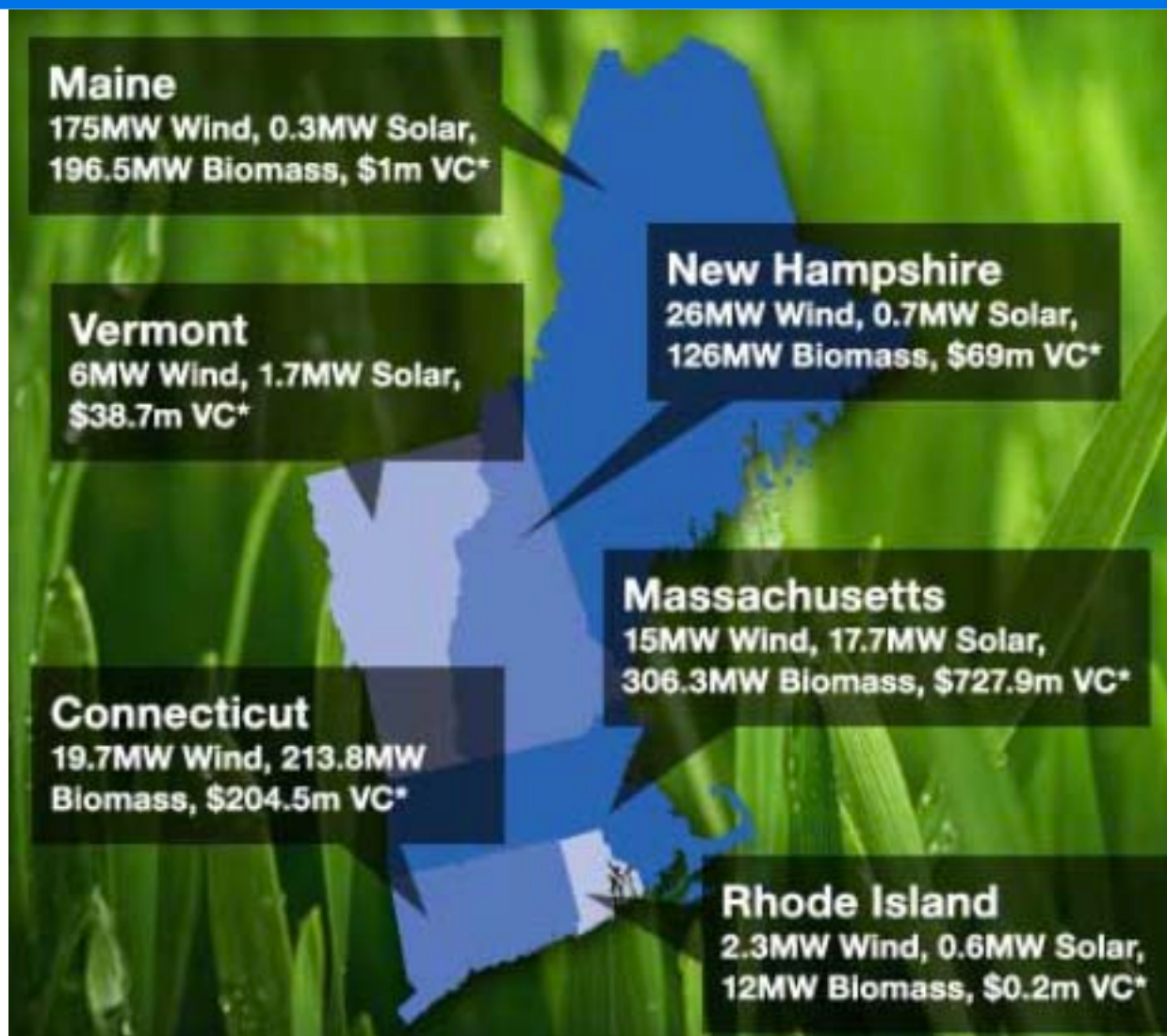
Springfield, MA

Peter Rothstein, President
New England Clean Energy Council

Council mission:

- ***To accelerate New England's clean energy economy to global leadership by building an active community of stakeholders and a world-class cluster of clean energy companies.***

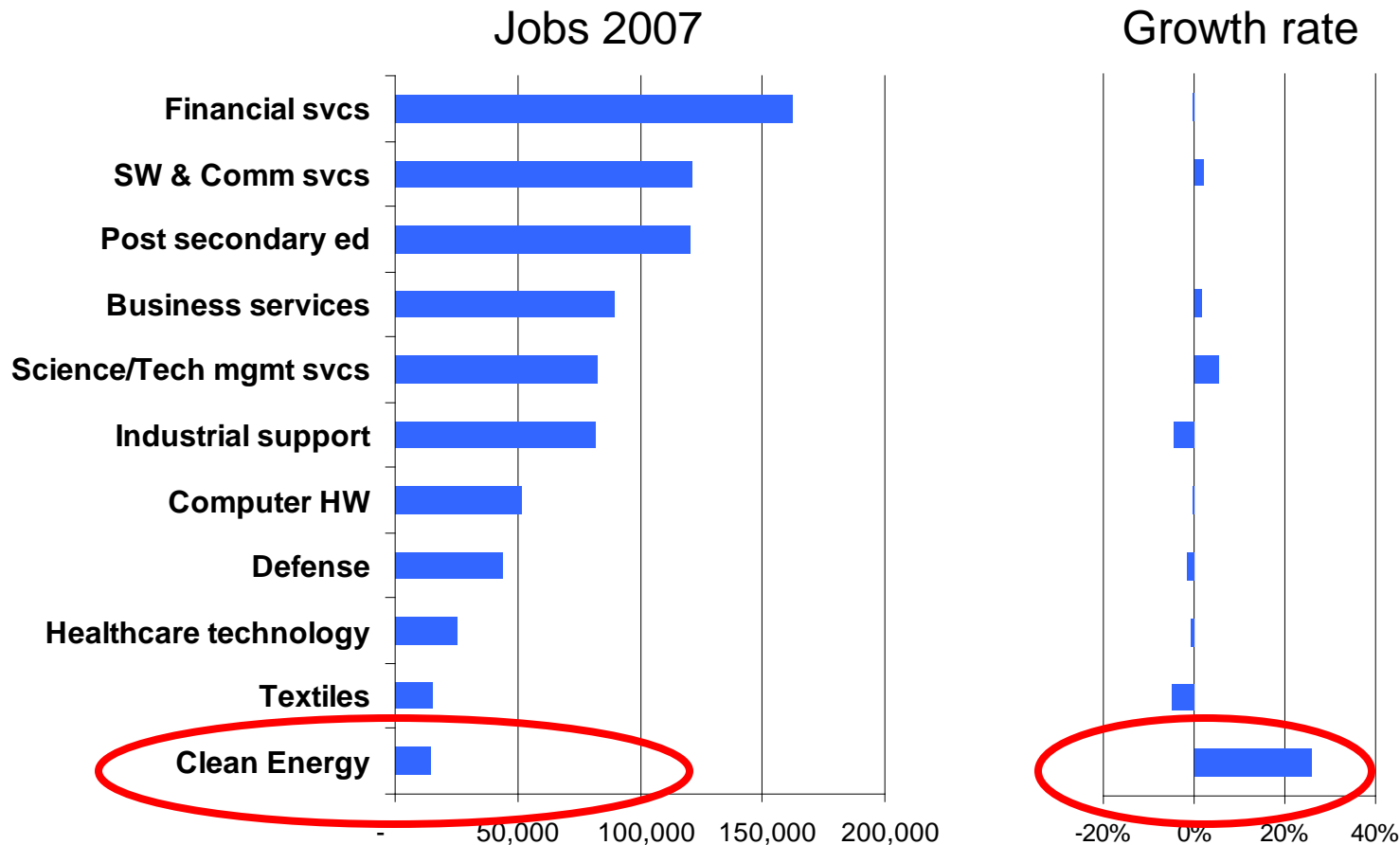
New England Clean Energy Growth



Source: ACORE

Clean Energy: Top 10 in Massachusetts

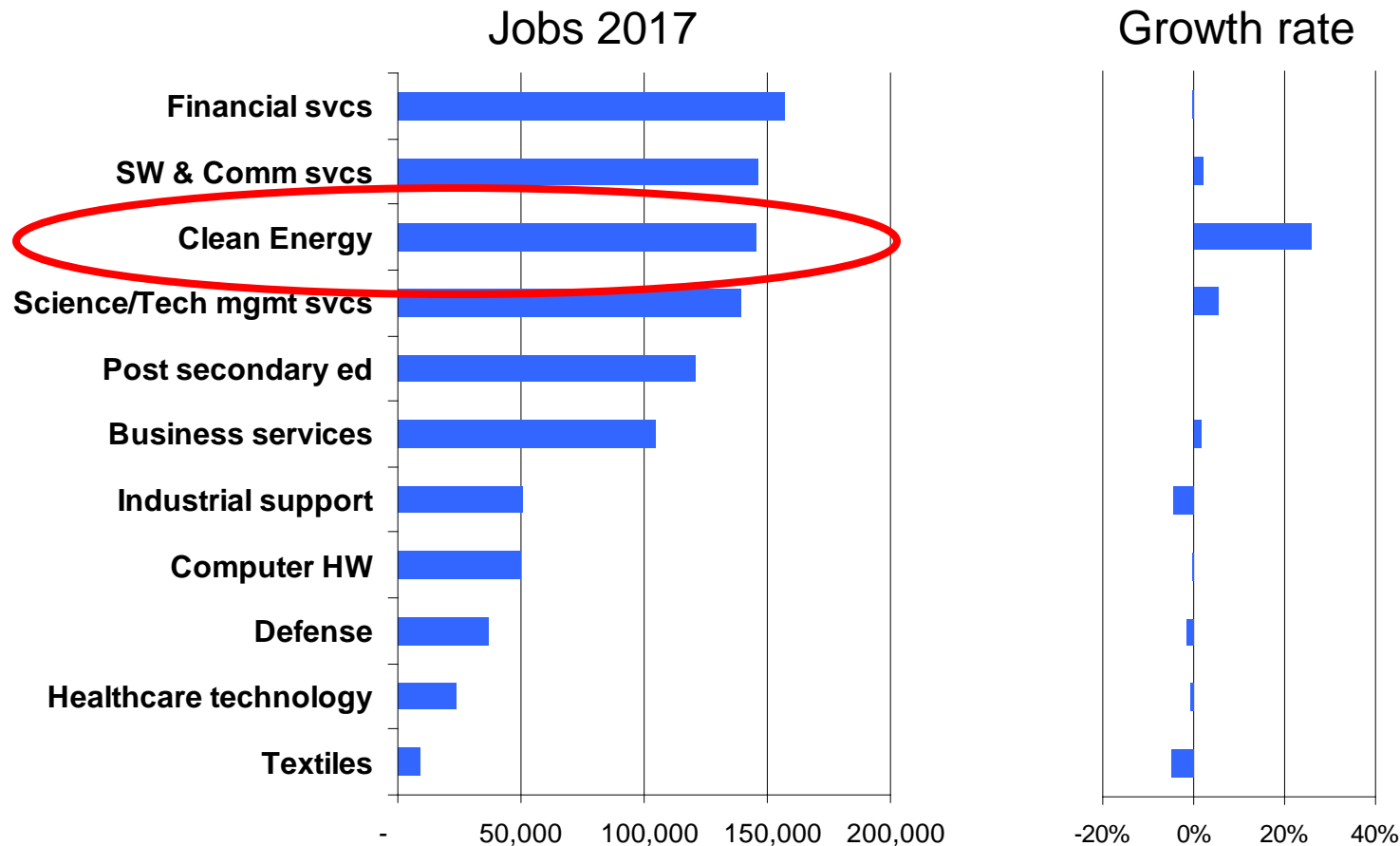
Clean energy has become the 10th largest industry sector in Massachusetts, and is growing fast



Source: John Adams Innovation Institute 2006 Index, Massachusetts Renewable Energy Trust, May, 2007

10 yr Growth, Clean Energy in Top 3

If Massachusetts can maintain the current growth rate, clean energy will be tied with software (#2) in just 10 years, providing nearly 150,000 jobs



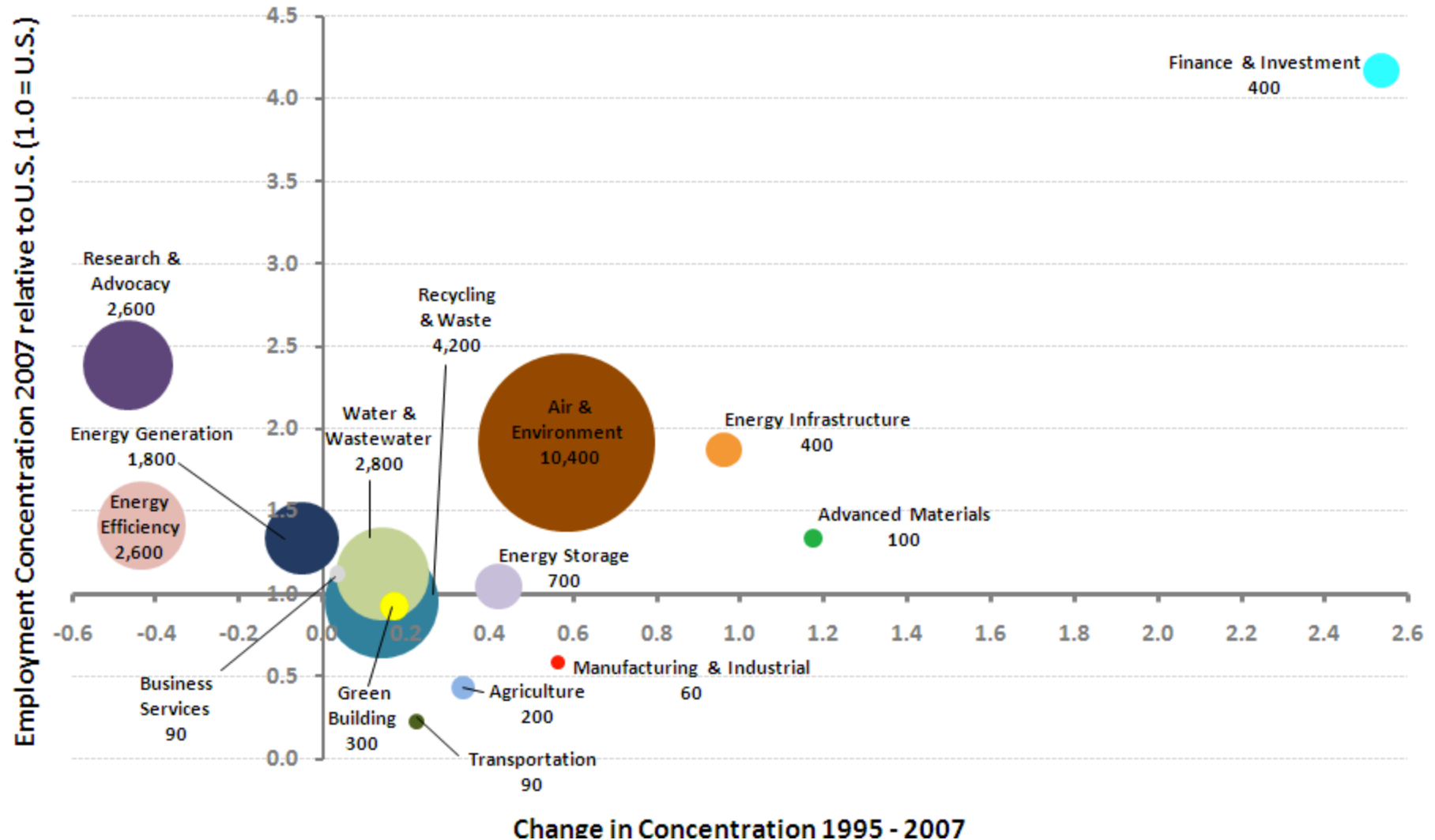
Source: John Adams Innovation Institute 2006 Index, Massachusetts Renewable Energy Trust, May, 2007

Mass. Clean Energy Jobs Growth



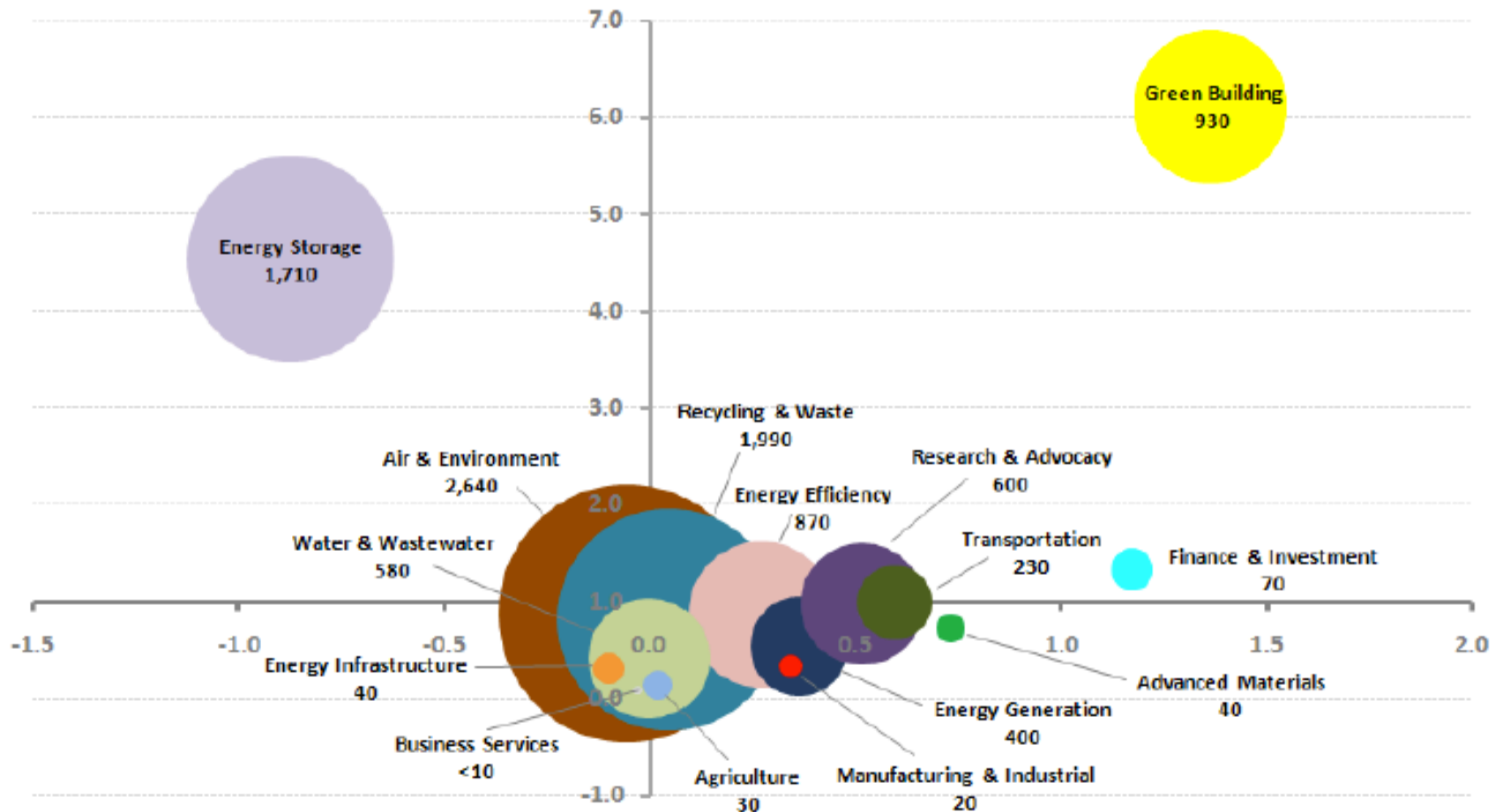
- Massachusetts clean energy sector businesses and jobs at an all-time high
- According to MassCEC survey, clean energy jobs increased approx. 65% from 2007 to 2010 – 14,400 to 23,000 jobs
- Using different green jobs definitions, last year Pew Charitable Trusts counted 1,912 green businesses in Massachusetts with a total of 26,678 green jobs

Mass. Employment by Green Segment, 1995-2007



CT Employment by Green Segment, 1995-2007

Employment Concentration 2007 relative to U.S. (1.0 = U.S.)



Change in Concentration 1995 - 2007

Clean Energy State Leadership Scorecard

State	Total Marks Earned (out of 56 possible)	Percent of Total Marks Possible
California	48	86%
Massachusetts	45	80%
Oregon	43	77%
Colorado	35	63%
New Jersey	35	63%
Connecticut	34	61%
New York	34	61%
Maryland	32	57%
Washington	32	57%
Minnesota	30	54%
Arizona	28	50%
Illinois	28	50%
Florida	24	43%
Pennsylvania	24	43%
Texas	20	36%

Source: Clean Edge, Inc., 2010

Mass. Winning DOE ARPA-E Awards



- In four rounds of ARPA-E grants awarded, Massachusetts entities received:
 - **13 percent of total awards and 17 percent of dollars**
 - **Of 123 awards, 16 Mass. Awardees received total of \$62.8 million**
- Mass. Companies funded by ARPA-E:
 - 1366 Direct Wafer: Enabling Terawatt Photovoltaics
 - Sun Catalytix: Affordable Energy from Water and Sunlight
 - FloDesign: Breakthrough High Efficiency Shrouded Wind Turbine
 - Agrivida: Conditionally Activated Enzymes Expressed in Cellulosic Energy Crops
 - Beacon Power: Development of a 100 kWh/100 kW Flywheel Energy Storage Module
 - Ginkgo Bioworks: Engineering E. Coli as an Electrofuels Chassis for Isooctane Production
 - General Compression: Fuel-Free, Ubiquitous, Compressed Air Energy Storage and Power Conditioning
 - FastCap: Low Cost, High Energy and Power Density, Nanotube-Enhanced Ultracapacitors
 - 24M: Semi-Solid Rechargeable Power Sources- Flexible, High Performance Storage for Vehicles
- Mass. University Lab projects funded by ARPA-E
 - MIT: Advanced Technologies for Integrated Power Electronics
 - MIT: Bioprocess and Microbe Engineering for Total Carbon Utilization in Biofuel Production
 - MIT: Electrochemically Mediated Separation for Carbon Capture and Mitigation
 - UMass: Electrofuels via Direct Electron Transfer from Electrodes to Microbes
 - MIT: Electrovill: High-Amperage Energy Storage Device-Energy Storage for the Neighborhood
 - MIT: Engineering *Ralstonia eutropha* for Production of Isobutanol, Motor Fuel from CO₂, H₂, Oxygen
 - Harvard Med: Engineering a Bacterial Reverse Fuel Cell

Massachusetts Leadership



- Massachusetts and California possess five essential characteristics that have made them prime targets for cleantech government funding:
 1. Access to venture capital and other investor networks;
 2. Academic, R&D, and innovation resources;
 3. Active state and local governments that provide incentives, act as customers, and create early market adoption conditions such as renewable portfolio standards;
 4. Already established cleantech clusters, organizations, and incubators; and
 5. A community of repeat entrepreneurs and a culture that connects this community and helps support their start-ups.

Massachusetts Policy Leadership Accelerating Clean Energy Sector & Jobs



- Consolidated energy & environment under Sec. Ian Bowles Cabinet post
- Establishment of Mass. Clean Energy Center in Green Jobs Act of 2008:
 - First state authority U.S. exclusively devoted to job creation, economic development in clean-energy sector
- The Green Communities Act:
 - Aggressive energy-efficiency programs with \$2B in public - private investments resulting in \$6B in savings – 3x more per capita than amount invested in California
 - Established “stretch” goal for building efficiency standards 20-30% higher than statewide building code
- The Global Warming Solutions Act:
 - Mandating 10- 25% reduction from 1990 levels by 2020 and 80 percent by 2050
 - February 2010 analysis by Eastern Research Group projected state on target to reduce statewide emissions by 18.6 percent by 2020
- Joining and leading within RGGI:
 - Northeast’s regional cap-and-trade system has generated \$116 million in carbon credits to date for Massachusetts – with most of the money going to investments in efficiency
- Instituted exemption from state gasoline tax for cellulosic biofuels
- Continuing to fund and sometimes expand programs through major economic downturn

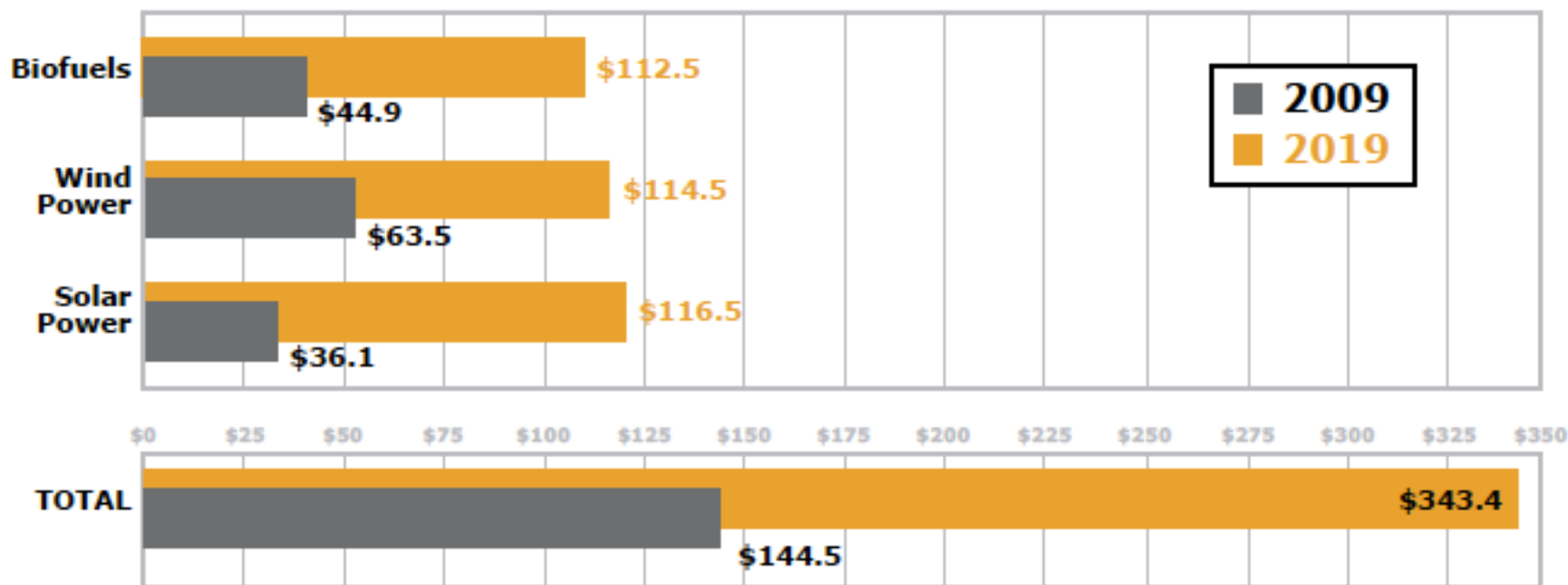
Mass. Renewables Growth

- Commonwealth Solar and federal Recovery Act investments, increased helped grow Mass. solar PV nearly 20-fold and wind power tenfold over 4 years
 - From 3.5 megawatts to more than 60 megawatts of solar
 - From 3.1 MW to over 30 MW of wind by end of 2010
- Solar energy installation firms 4x in 1.5 years
- Employment in solar manufacturing and installation more nearly tripled since 2007
- Cape Wind expected to be first offshore wind farm in US



Global Clean Energy Markets & Evolution of Cleantech

Global Clean Energy Projects Growth 2009-2019 (*\$US Billions*)



Source: Clean Edge, 2010

Global Renewables Subsidies Dwarfed by Fossil Fuel Support

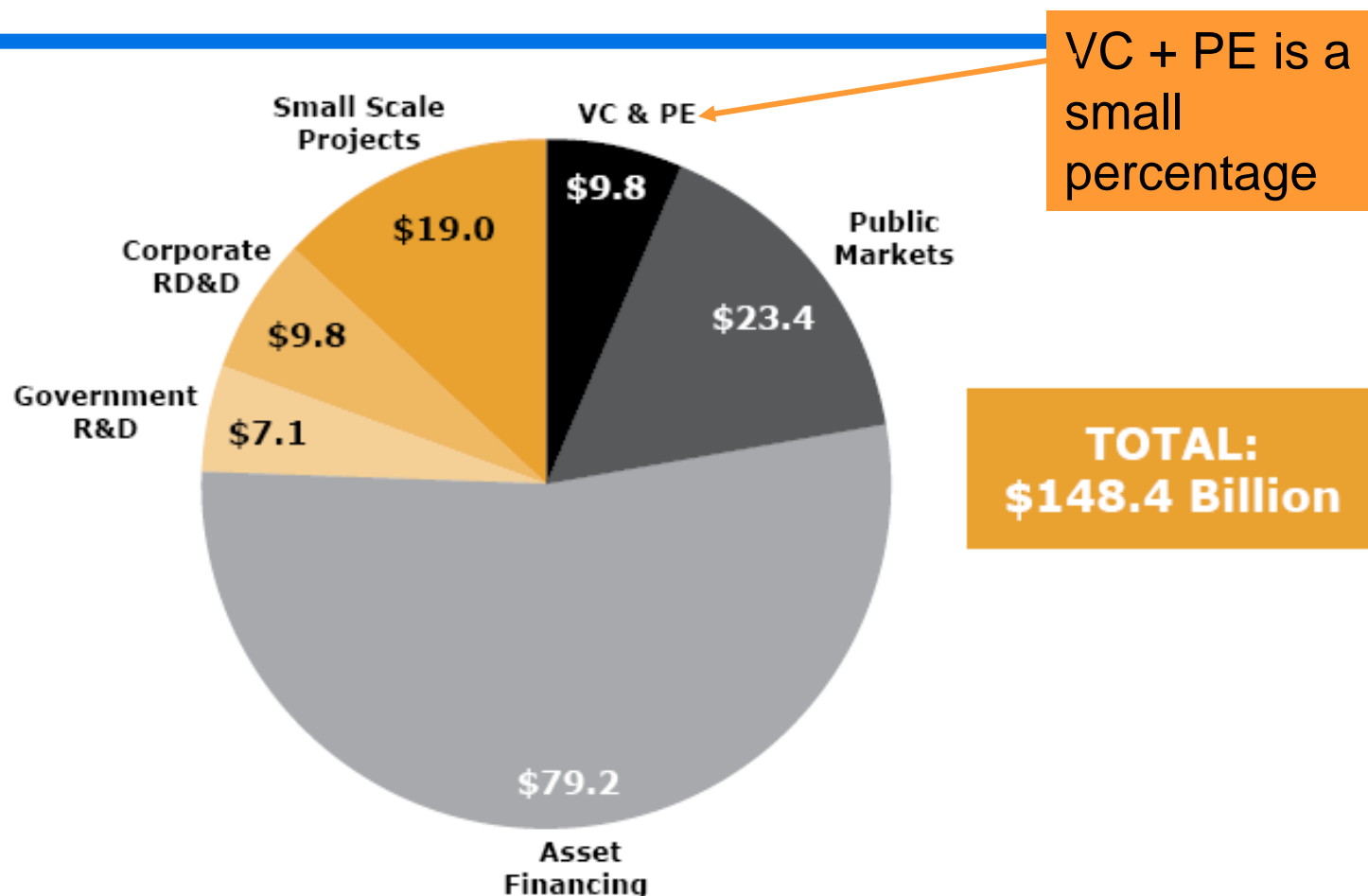


- World governments provided approx. \$43-46B to renewable energy and biofuels technologies, projects, and companies in 2009
- By comparison, government provided \$557bn on subsidizing fossil fuels in 2008, estimated by IEA
- Source: Bloomberg New Energy Finance

Global Clean Energy Investments – Mixed Signs

- In global recession in 2009, global investments in sustainable energy increased worldwide
- Clean energy investments from private and public sources totaled \$162B
- U.S. renewable energy power capacity increased more than non-renewable sources like coal, gas and nuclear in 2009
- Investments in large-scale solar PV dropped dramatically WW as cost of technology also dropped dramatically
- Biofuels had \$18B of investment WW in 2008, but just \$7B in 2009
- China passed U.S. as country with greatest investment in clean energy
- For first time, private sector green energy investments in Asia and Oceania, some \$40.8B in 2009, exceeded the Americas at \$32.3B (Europe was down 10% at \$43.7B)
- Government clean energy began to slow somewhat in spring 2010, thanks to new phase of the economic downturn, market volatility and governments facing pressure to cut their deficits

2007 Global Clean Energy Investments (\$US Billions)



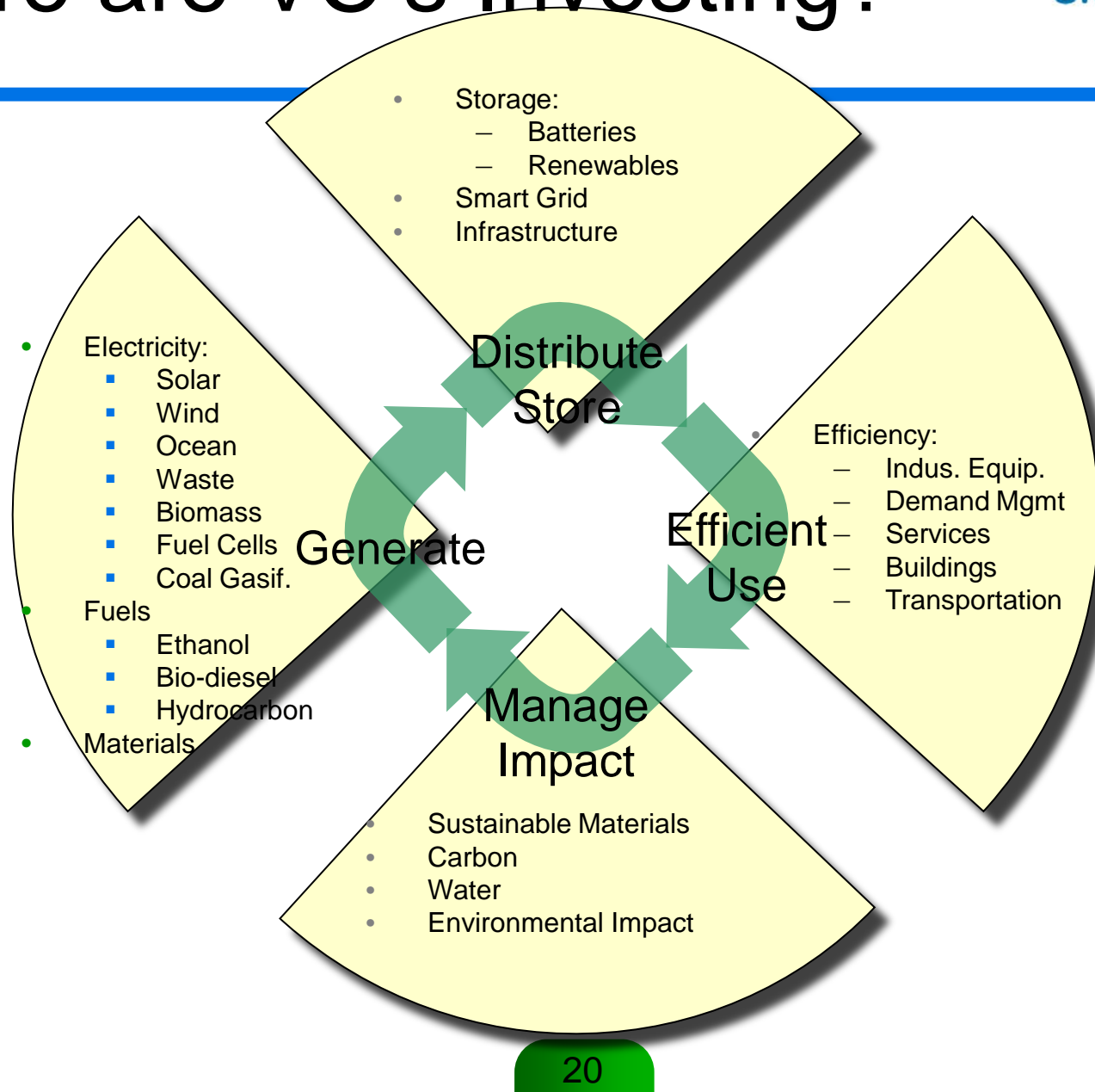
Source: New Energy Finance. NOTE: Asset financing figure includes a downward adjustment of \$5.3bn, reflecting a subsequent reinvestment in projects of VC, PE and public market funds raised by clean-energy companies. Re-investment assumes a one-year lag.

Clean Energy VC Investments in US Companies as % of Total VC

Year	Total Venture Investments (US\$ Billions)	Energy Technology Investments (US\$ Millions)	Energy Technology Percentage of Venture Total
2001	\$40.6	\$351	0.9%
2002	\$22.0	\$271	1.2%
2003	\$19.7	\$424	2.2%
2004	\$22.5	\$650	2.9%
2005	\$23.0	\$797	3.5%
2006	\$26.5	\$1,308	4.9%
2007	\$29.4	\$2,867	9.8%
2008	\$28.3	\$3,213	11.4%
2009	\$17.7	\$2,216	12.5%

Source: Bloomberg New Energy Finance with supporting data from Clean Edge and Nth Power, 2010. NOTE: New Energy Finance's energy-tech VC numbers include investment in renewable energy, biofuels, low-carbon technologies, and the carbon markets. VC figures are for development and initial commercialization of technologies, products, and services, and do not include private investments in public equity (PIPE) or expansion capital deals.

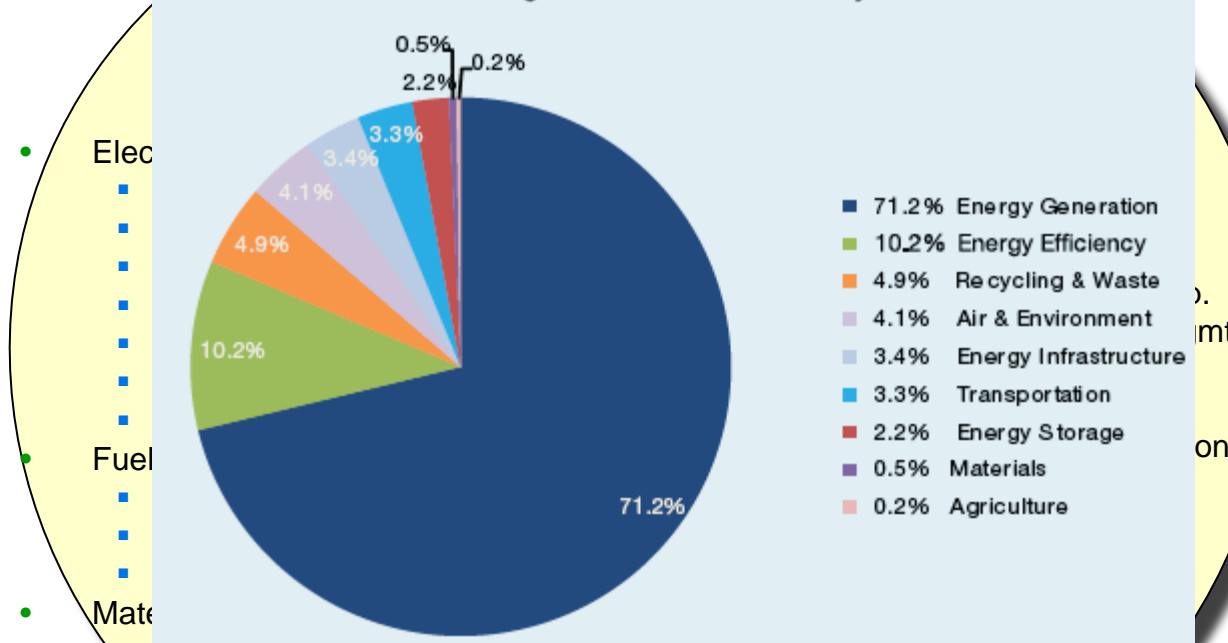
Where are VC's Investing?



Where are VC's Investing?

- Storage:
 - Batteries
 - Renewables

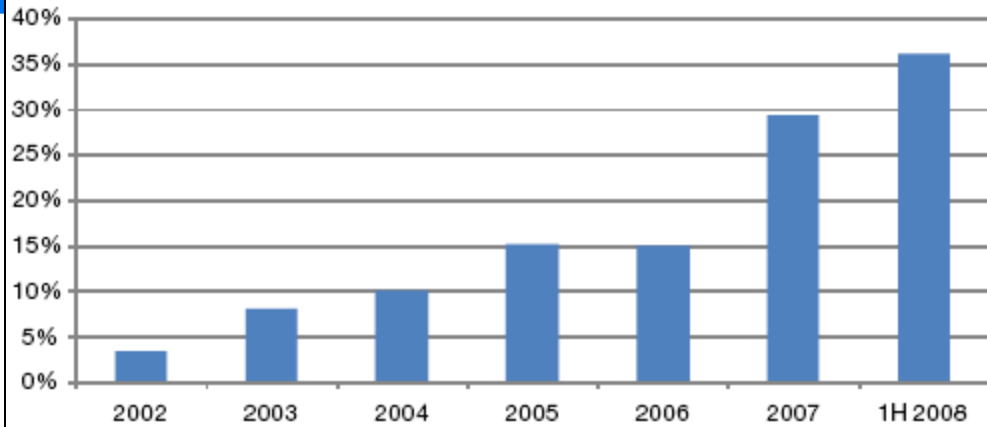
North America 2Q08 Percentage of Total VC Investment by Sector



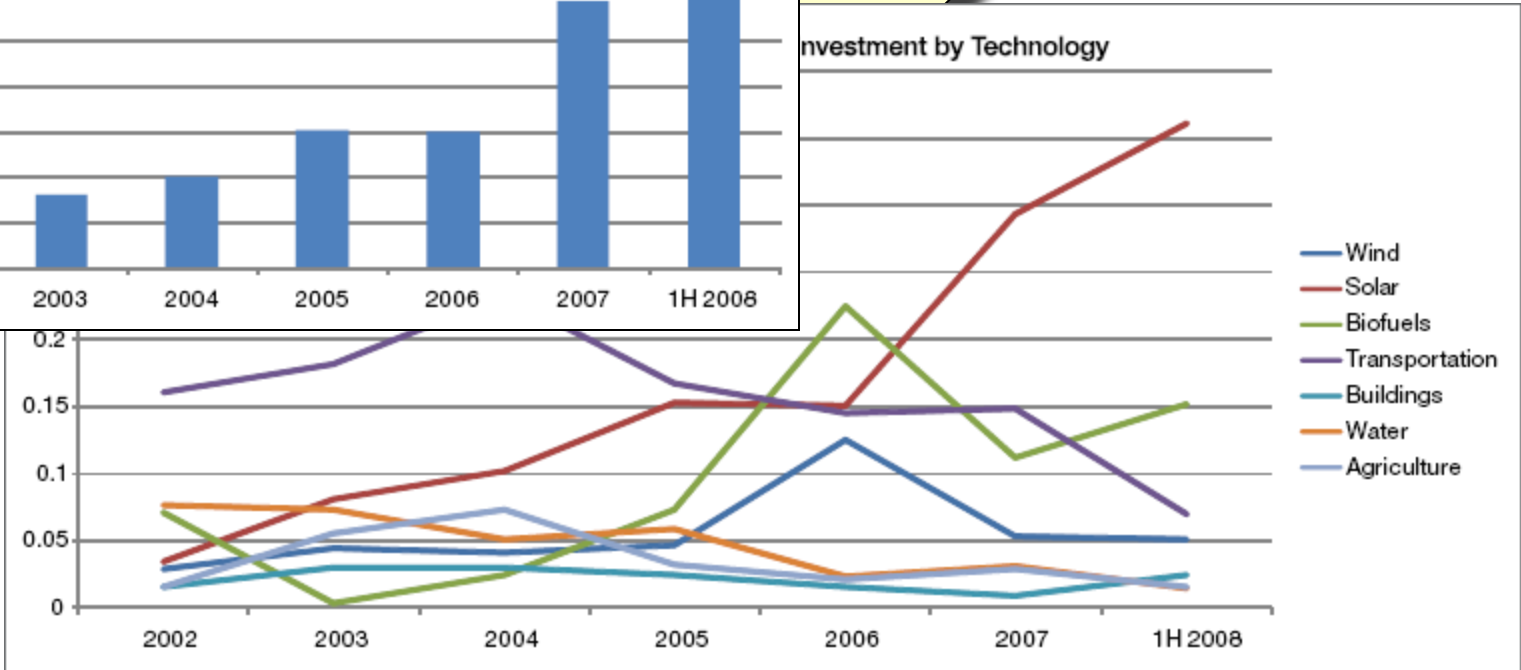
- Sustainable Materials
- Carbon
- Water
- Environmental Impact

Where are VC's Investing?

Solar's Share of Global Cleantech VC Investment



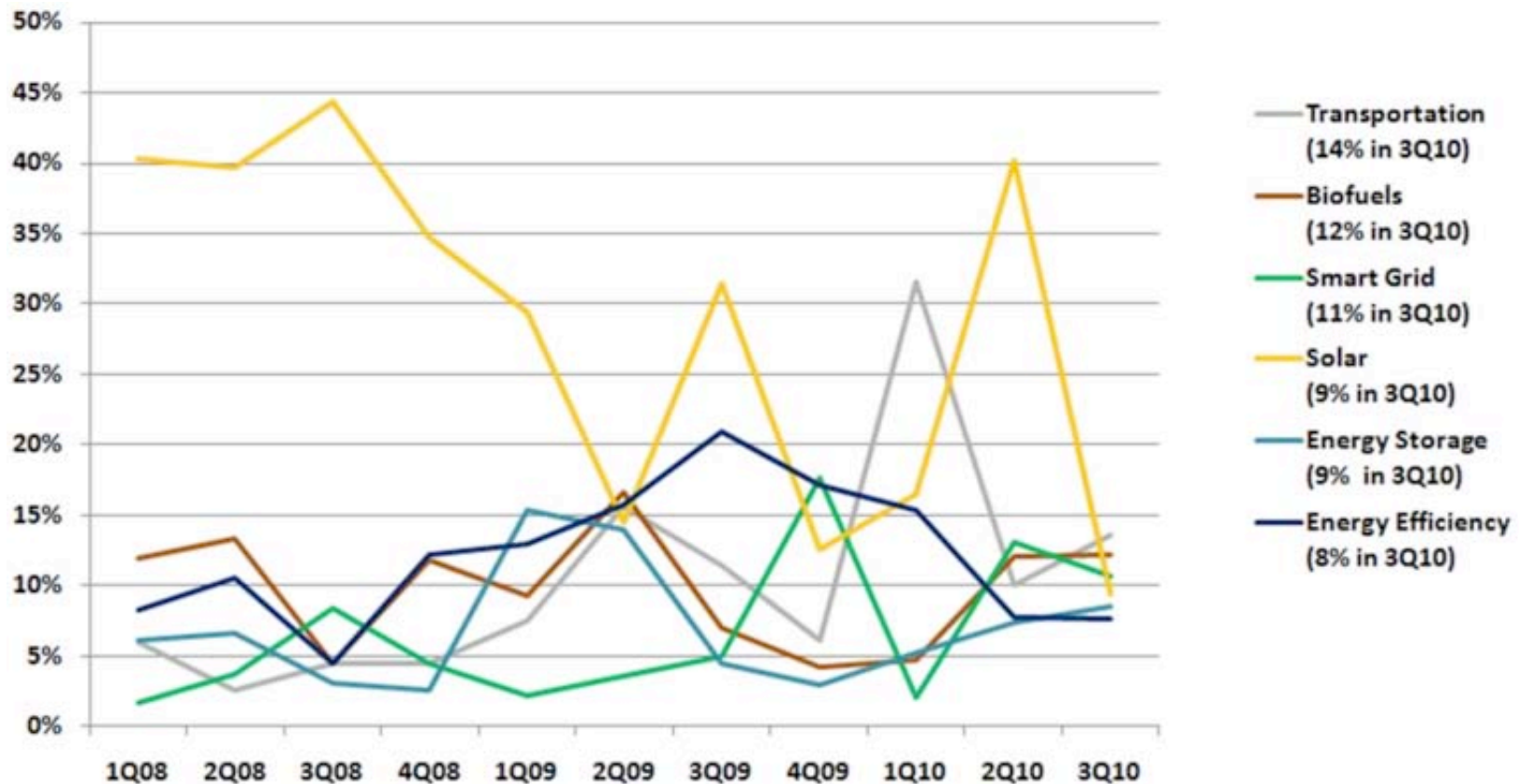
Investment by Technology



Impact

- Sustainable Materials
- Carbon
- Water
- Environmental Impact

Top Cleantech VC Sectors by Amount Invested



- Small number of large deals from qtr-to-qtr causes extreme volatility

Cleantech Venture Models are Different

	Life Sciences	IT	Energy & Environment
Addressable market size	\$1T (\$500B pharma, \$500B med devices)	\$1.3T (global corporate IT spending)	~\$3T (\$1T energy, \$1T water, \$1T all other)
Key sources of innovation	Biotech, chemistry	SW developer creativity, consumers	Materials, biotech, CE, ME
Capital intensity	High	Low	Very high
invention to commercialization	Years	Months to years	Years to decades
Pricing models	Unique monopolies	Value pricing; high margins	Commodities
Channels	Established, accessible	Established, very accessible	Underdeveloped
Valuation comps	Well established	Well established	Poorly established
Government influence	High, but very predictable	Low	High and unpredictable
Exit Prospects	Many comps, pre-rev/pre-product	Many comps, pre-revenue exit possible	Few comps, need to commercialize

Source: Lux Research



Developing the New England Cleantech Cluster

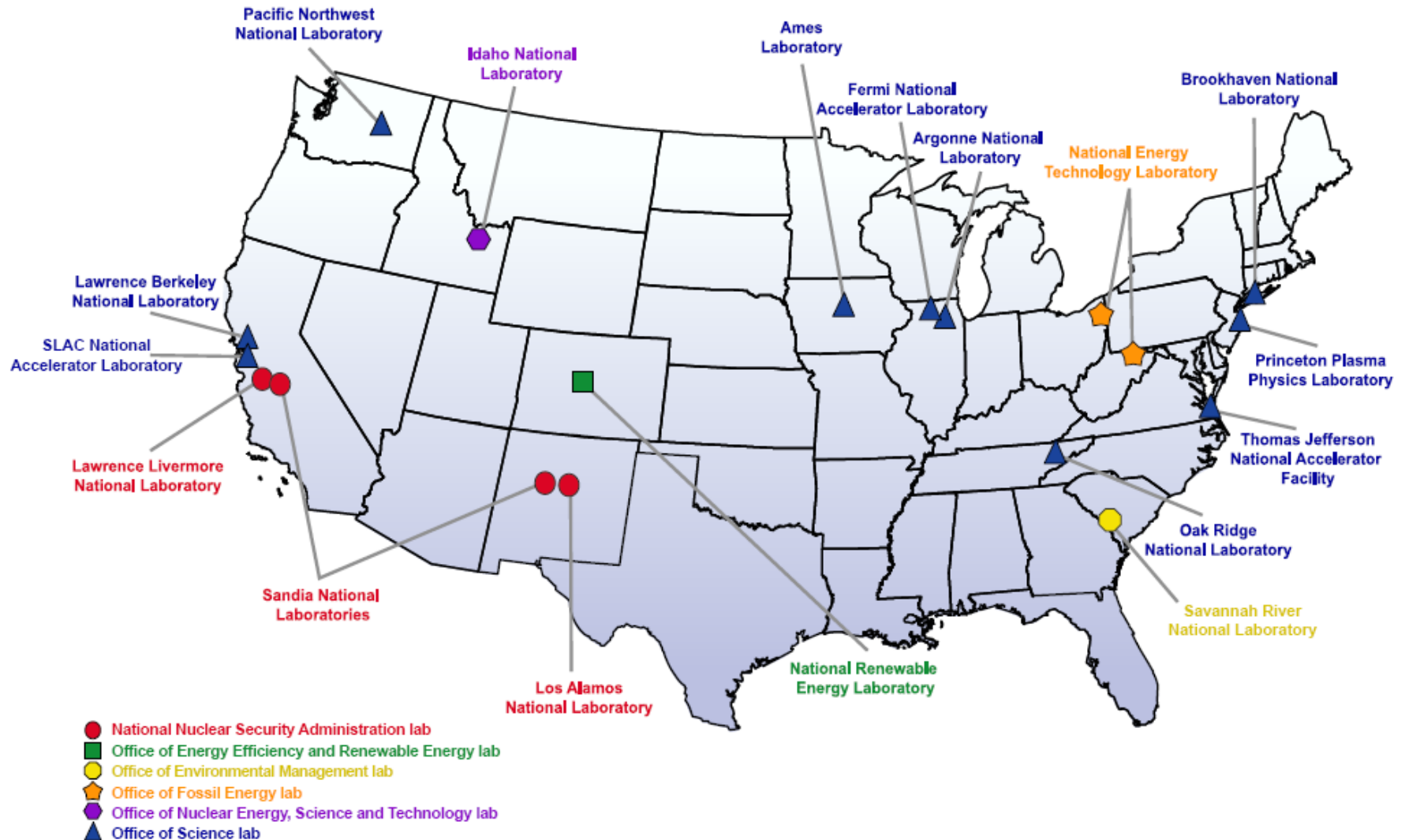
Massachusetts Clean Energy Strengths / Weaknesses

Strengths/Assets	Weaknesses/Barriers
World-Class Academic, R&D, and Innovation Resources	High Costs of Living and Energy (high overhead for manufacturing)
Deep Commitment to Energy Efficiency	Innovation-to-Commercialization Gaps
Strong Government Leadership and Policy Support	Limited Natural Resources for Clean Energy
Robust Venture Capital Resources	Local-Rule Tradition/Permitting Delays/NIMBYism
High Energy Demand and Costs (easier for renewables to compete on price, good incentives for conservation/efficiency)	Risk-Averse Financial Community
Highly Educated Workforce	Lack of a National Energy Laboratory
Green-Minded, Supportive Citizenry	Limited Clean-Energy Manufacturing Infrastructure

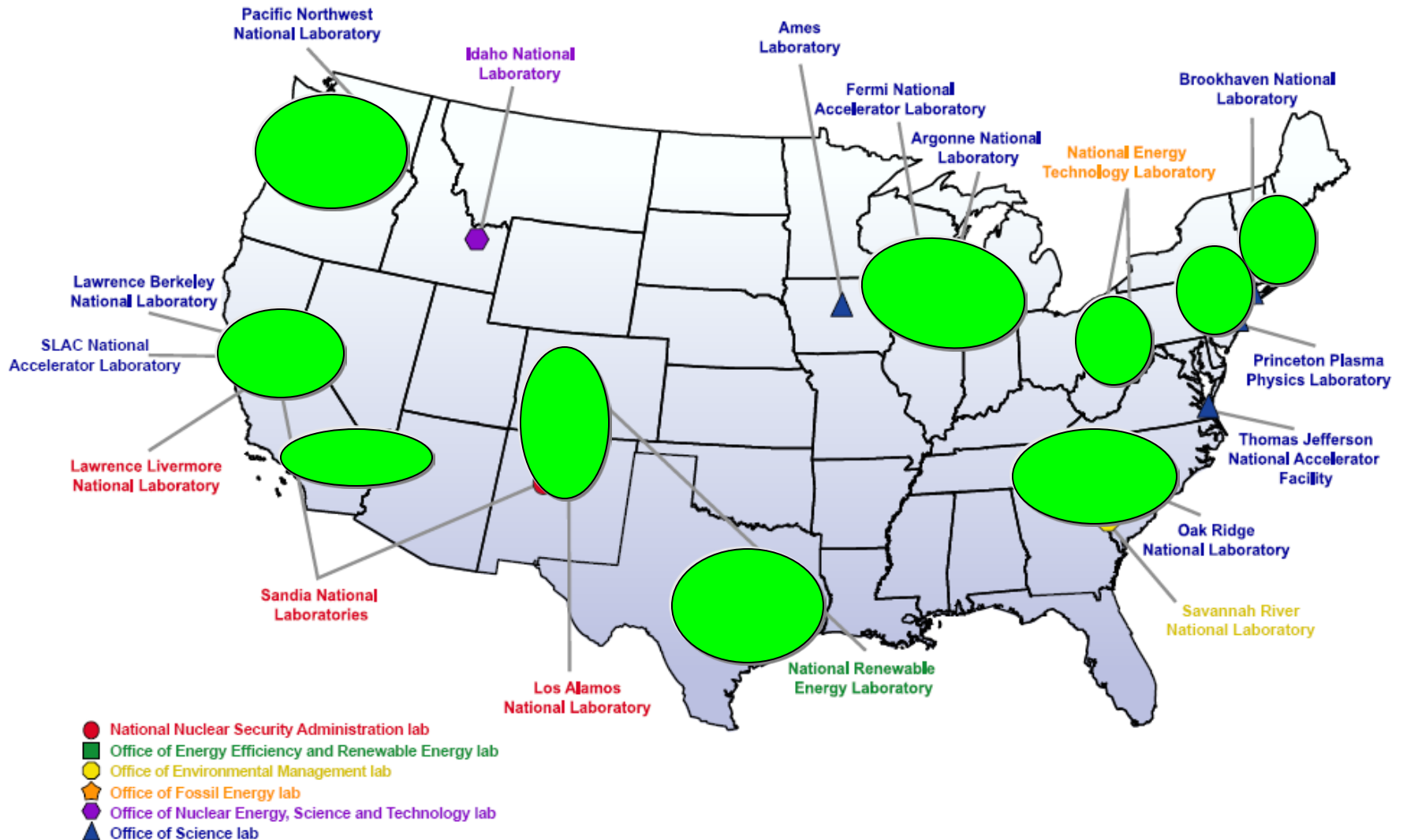
“The vitality of the U.S. economy... depends on creating innovation and competitiveness at the regional level.”

*Professor Michael Porter
Harvard University & Monitor Group
Council on Competitiveness, 2002*

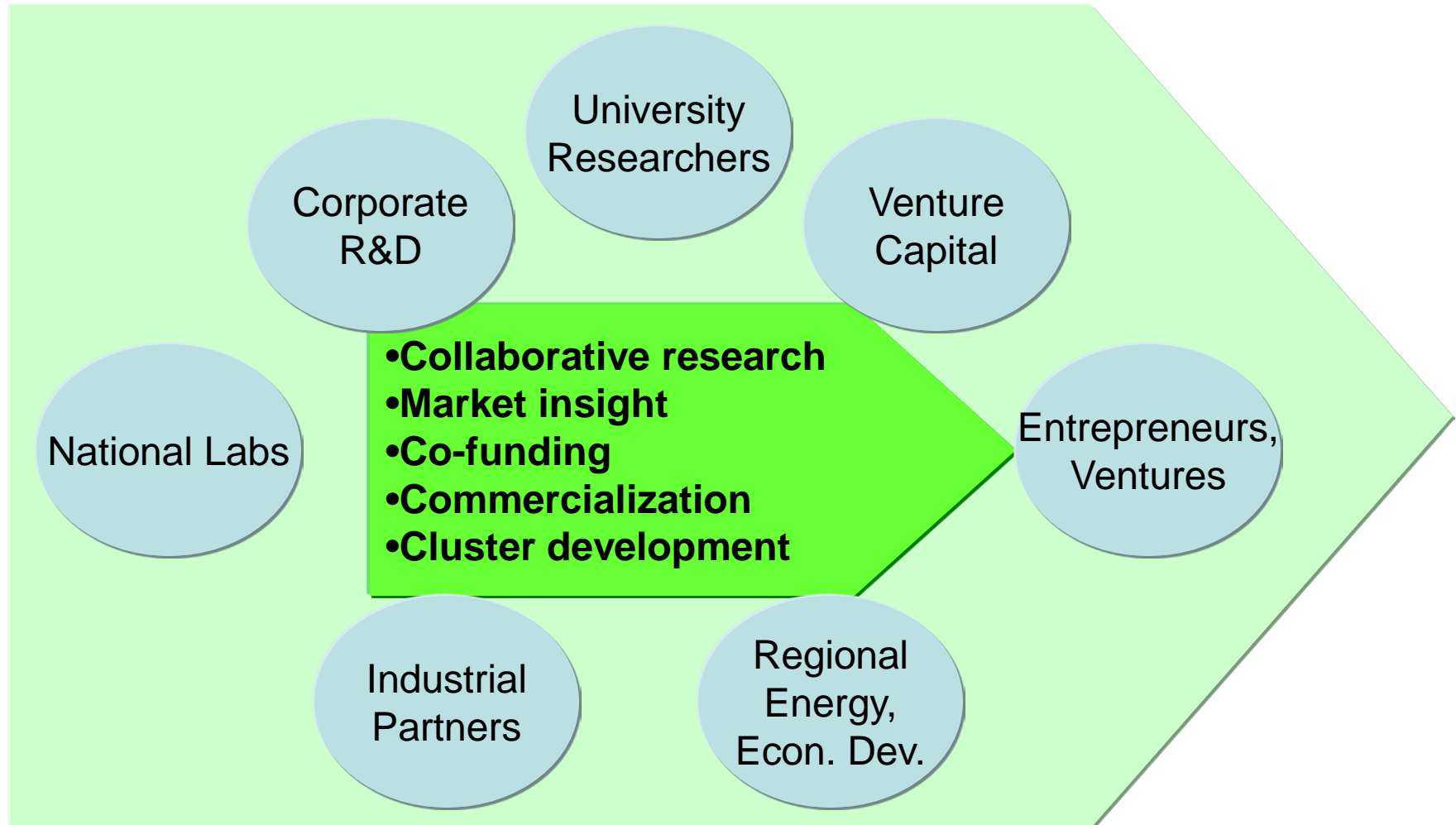
DOE National Labs



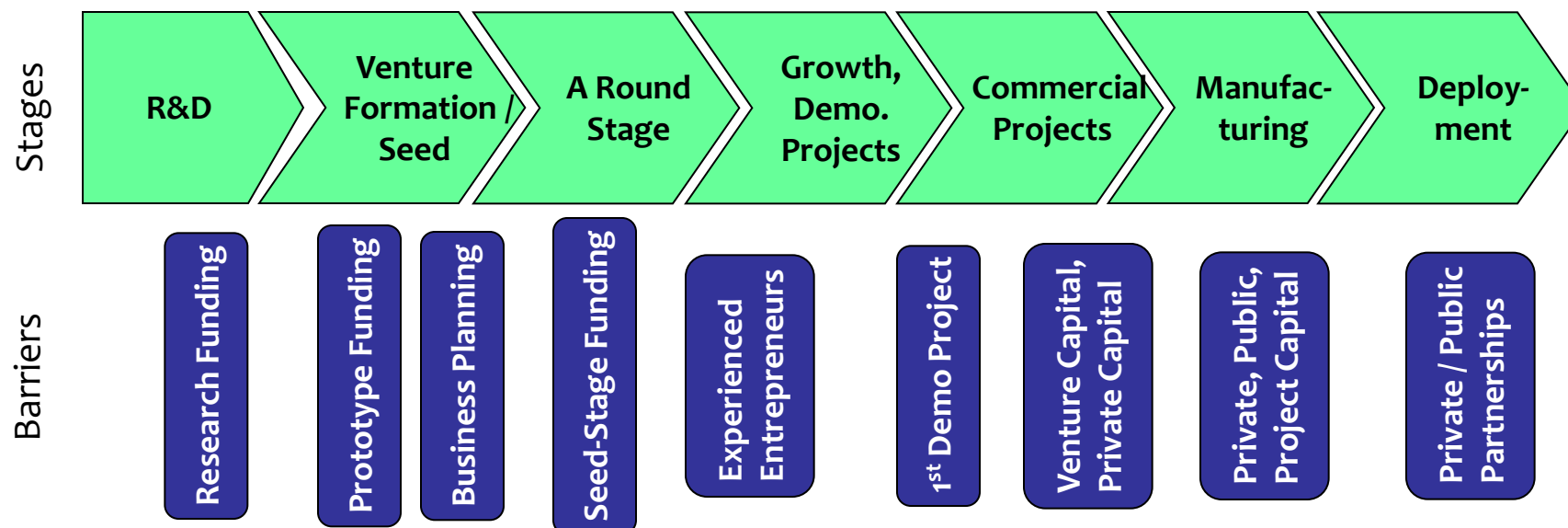
Emerging Clean Energy Clusters



Cluster Stakeholders



Building the Massachusetts Innovation-Based Clean Energy Cluster



- Need to expand R&D – dozens of segments
- Sector is new – models and expertise evolving
- Early-stage seed, venture creation gaps
- Wide range of financial partners needed
- Competition in project siting, manufacturing investment
- Skills training to develop green jobs for deployment

Council's Current Programs

Innovation

- Consortia
- Mentorship / EIR Program
- Fellowship & Exec Ed

Growth

- DC Fly-in
- Conference partnerships
- Finance Series

Education

- Workforce Development – Employer Forums
- Workforce training DB

Adoption

- Gov Clean Energy Challenge
- Developers Roundtable

Policy

- Climate / energy federal advocacy
- State, regional policy initiatives
- *NEW*: RGGI & N.E. Clean Energy 2.0

Clean Energy Fellowship Program



- **Problem:**
The clean energy sector has few repeat entrepreneurs
- **Solution:**
An executive development and venture development program for experienced entrepreneurs from other sectors to acquire clean energy sector knowledge and move into entrepreneurial leadership roles with clean energy ventures
- **Goal:**
Increase the number of energy-focused entrepreneurs and accelerate the successful growth of local clean energy ventures

Fellowship Program Results

- Fellowship I – 12 Fellows pilot in 2008 – one year later:
 - 6 of 11 participants were unemployed pre-program
 - 10 out of 11 actively involved in new start-up (including 7 CEOs, 1 Board Member/Consultant)
 - Broad range of clean energy companies in solar, wind, storage, water, transportation, etc.
 - These ventures forecast an estimated 235-480 new jobs to be created over next 3-5 year period
- Fellowship II – 25 Fellows in summer 2009:
 - 8 new companies in first few months, many with teams of Fellows
 - Includes clean energy technology & energy services companies seeking to hire for energy efficiency and renewables projects
- Fellows' feedback:
 - “If someone is considering entry into cleantech, it is too risky to make the transition without a program such as the Fellowship to provide the needed perspectives, vision and contacts. It would take two to three years of trial and error to achieve the same learning across such a broad spectrum.”

NECEC & BU: Executive Certificate Fellowship in Leading Cleantech Ventures



- Council's Fellowship Program becomes new Cleantech Ventures Executive Certificate joint program with BU School of Management
 - Registration begins in late October
 - 1st program late February – April
 - 3 residential periods with distance learning in between
 - Capstone projects
 - Council network involvement
 - For entrepreneurs and intrapreneurs
- Raising scholarship fund (corporate, government, foundation)
 - Program charging \$6,995 tuition

Workforce Needs Employer Forums



- June 23, 2010 - over 125 attendees from northeastern MA met at UMass Lowell
- September 28, 2010 – over 100 attendees in New Bedford forum
- Springfield forum being planned for November
- Sponsored by the Massachusetts Clean Energy Center, the Council, UMass Lowell, UMass Boston and the Garfield Foundation
- Recommendations aimed at workforce needs and job creation potential in clean energy sector
- Final report from three Forums to be distributed end of 2010

New England Energy Innovation Consortium



- New England Energy Innovation Consortium (NEEIC) in planning and formation
- NEEIC is being established to support:
 - Increased clean energy research and development
 - Accelerate technology commercialization and clean energy ventures, and
 - Build the clean energy cluster network in New England
- Goal is to form a consortium including industry, universities, government, non-profits, finance and other members of the New England energy innovation community

Obstacles & Opportunities Remain in Green Economy

- The global recession has made fewer investor dollars available
- The capital intensity of cleantech has made scale-up funding difficult
- Most challenging, the lack of a U.S. federal energy policy has left uncertainty on how to develop cleantech companies in U.S.
- However, clean energy is one of few growth sectors with new jobs
- Long-term market opportunity remains strong:
 - Energy is forecasted to be a \$6 Trillion market
 - Global climate and energy policies having impact
- Massachusetts and New England has one of the strongest cleantech clusters, with strong public-private collaboration:
 - Human capital, intellectual capital, financial capital, cluster network
- Many opportunities to grow new businesses in the Green Economy



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