UMASS BOSTON COLLEGE OF Management

Center for Sustainable Enterprise and Regional Competitiveness

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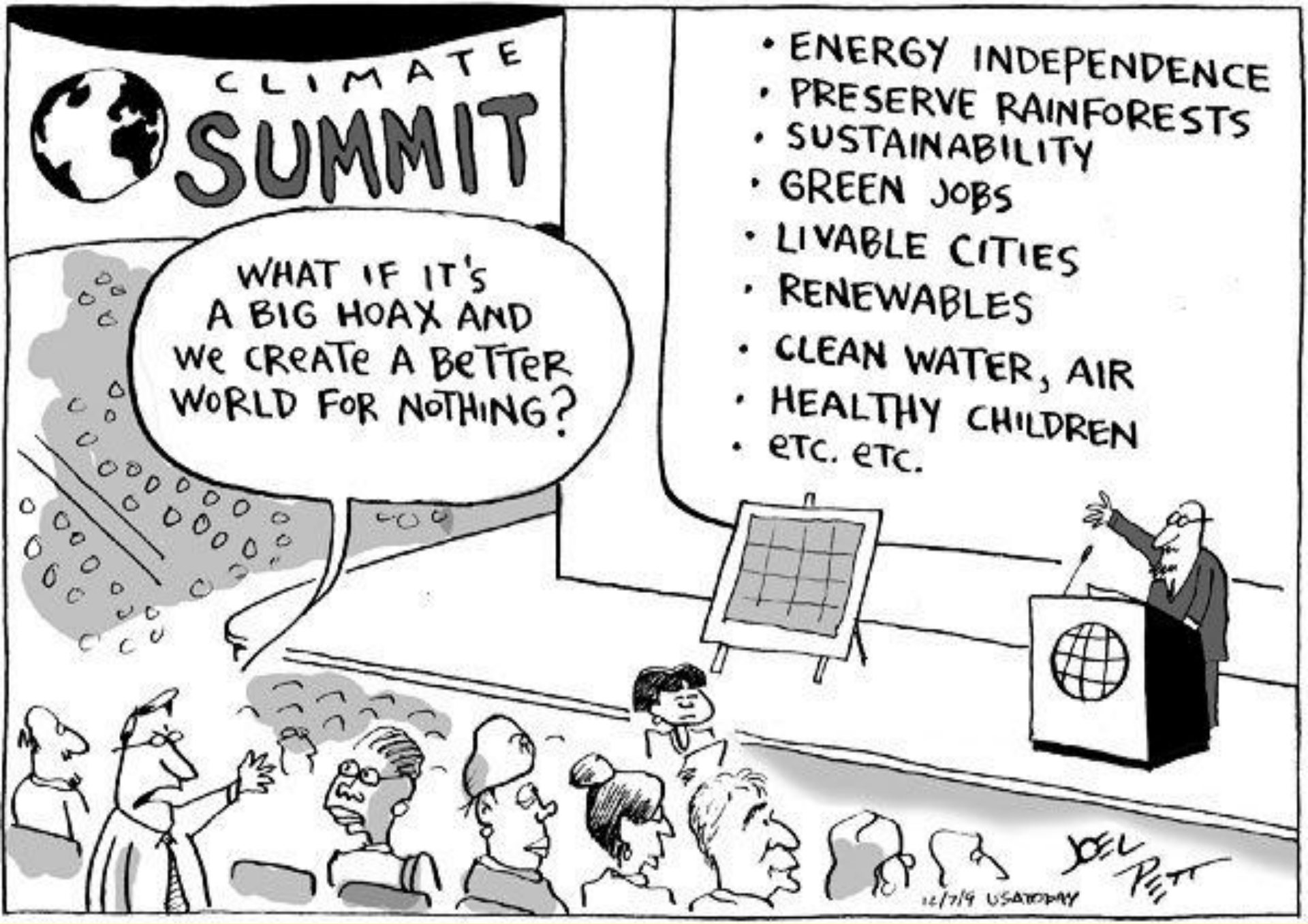
Business and Climate Change: Threats and Opportunities in the Transition to a Clean Economy

MIT-NESCAUM Symposium

Endicott House, Dedham 8.16.2011


CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• ETC. ETC.
12/7/14 USATODAY
JOEL PETT

There's NO Business like CO_2 Business

Investment to reach 450 ppm, 2^0 goal estimated at **$600-800 billion/year** worldwide, 80-90% from private sources

Global carbon market: $143 bn 2009, 8.7 bn tonnes C02e

Clean tech 23% of US VC funding, $5 bn. 2010

Global investment in clean energy $243 bn, 2010, up 30%

A123 Systems Raised $378 million Sep. 2009

Zipcar raised $174 million April 2011

From *Hope*nhagen to *Broken*hagen?

- Climategate Nov. 2009

- Collapse of Copenhagen climate negs. Dec. 2009

- Nov. 2010 Republican victory, tea-party politics

- Deficits, austerity, unemployment and budget cuts

- End of US Cap & Trade?

-- Action at local levels?

- Cheap natural gas, carbon price < $20/tCO2e

- Defections from USCAP – BP, Caterpillar

Multinational Corporations as Critical Players

Overt political strategies:
Trade Assocs., Lobbying, Campaign donations, Govt. agency links

Discursive Politics:
Engaging in public debates, advertising and media

Market/Technological strategies:
roles as investors, project developers, polluters, innovators, experts, producers, lobbyists, marketers, employers, & price setters

Private market based governance – private decisions (routine and strategic) structure economic activity and social world

Climate Change/Clean-tech: Most Important Strategic Issue Facing Business in 21st Century

1. Direct cost impact: cost of fuels and power, allowances
2. Physical Risks: Insurance, Agriculture, Real Estate, Infrastructure
3. Strategic impact: new technologies, competitors, markets, competencies
3. Carbon mgt and cost control: compliance, fuel switching, efficiency, process improvements, logistics, facilities mgt.
4. Corporate Branding and Product Differentiation: at corporate, facility, product levels
5. Demand impacts: e.g. fuels, lighting; cleantech; software, smart-grid
6. Financial: Carbon trading, Green ETFs, Carbon risk/premium

Physical Risks:

Water Scarcity

Impact on:

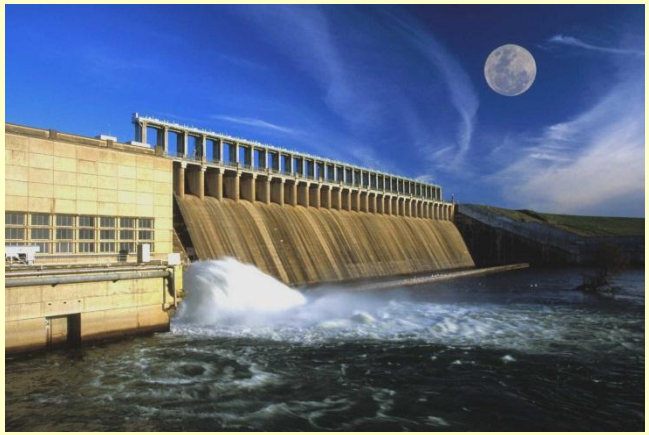
Agriculture

Industry

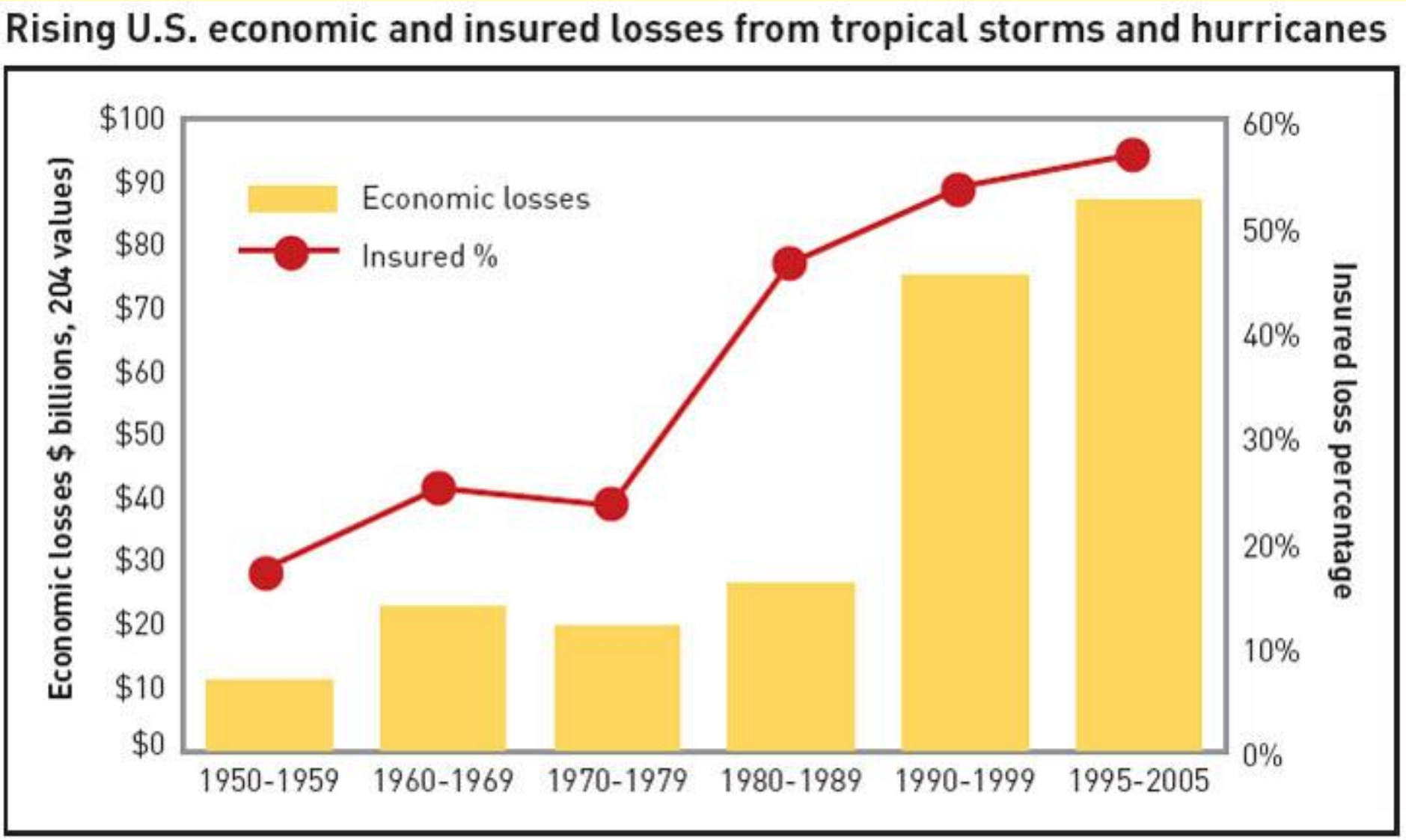
Health

Power production

Transportation

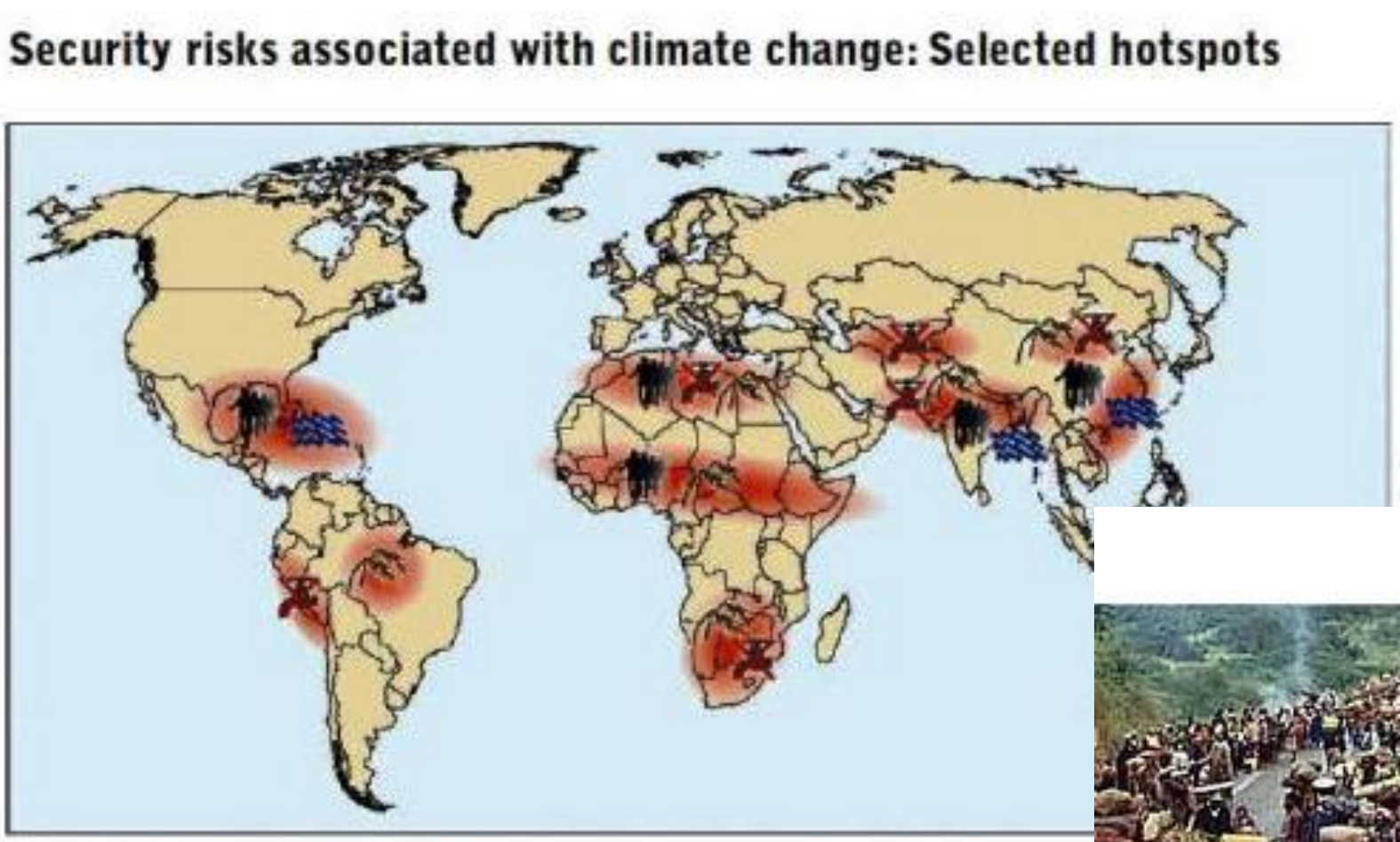


Insurance Costs:



Source: American Re (2005)

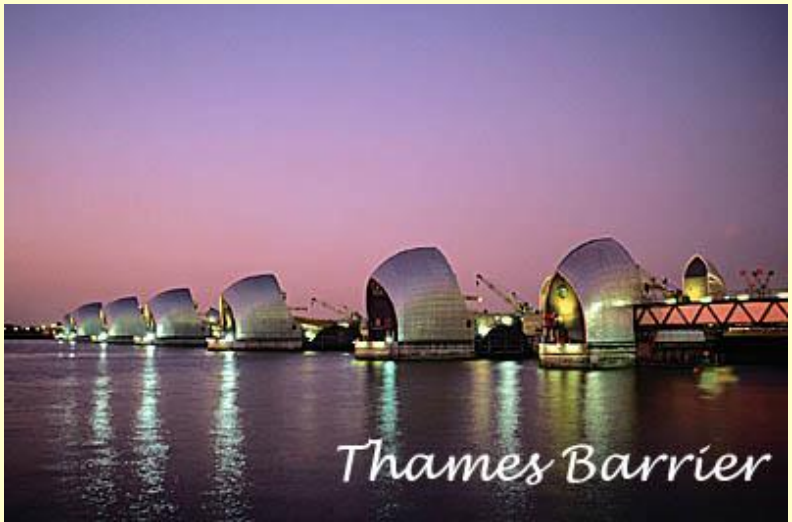
Security Risks: Refugees, Resources



The map only shows the regions which are

Economic Costs

- Real estate and tourism
- Obsolescence
- Health – malaria, malnutrition
- Technological and financial risk
-- Large Scale Mitigation Projects



Strategic Dilemmas for Business

- First mover advantages vs. risks of early investment
- High uncertainty re science, policy, technologies, markets
- Risks of new products and markets
- Reputational impact
- Seat at policy table, political positioning
- Hedging strategies
- Risk of policy fragmentation
- Risk of major climate crisis, war-time mobilization

Inertia in sub-system causes instability: Fossil-Fuel Energy System

Economic/Material: Technologies 'perform', infrastructure lock-in, dominant firms with BTEs, econs. of scale, core capabilities

Organizational/Political: Industry assocs, govt agencies, subsidies, policy influence, 'highway coalition'

Normative-cultural: private consumption/mobility, status; routines, standard practices, norms and values

IPIECA

Transition to Low-Emission Energy System?

Inertia of existing system:

Renewable technologies do not perform

VC capital avoids extreme risks

Business models for renewables uncertain

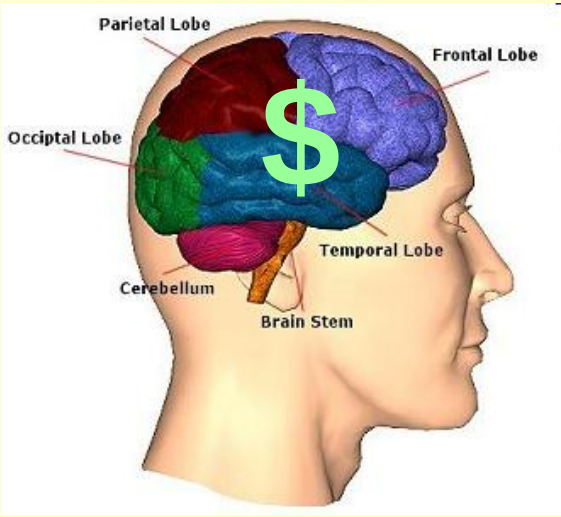
Political power of renewable companies weak

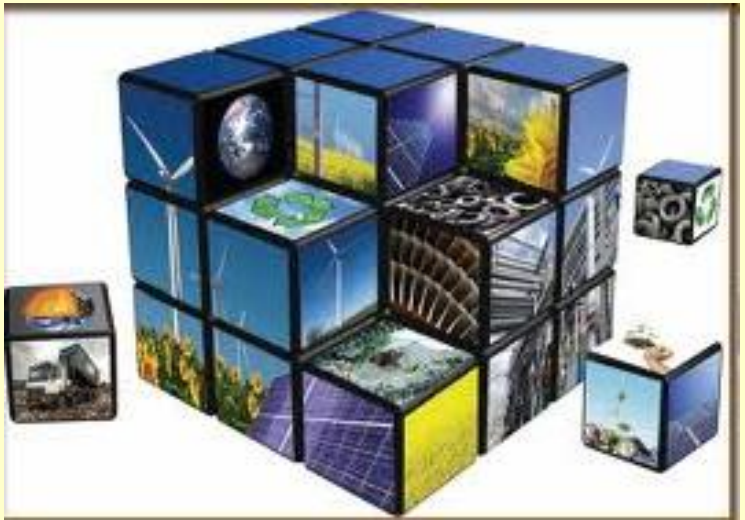
Difficulty of shifting norms, standards, attitudes, practices

Corporate Clean Energy Strategies

depends on ***expectations*** regarding:

- Carbon, energy prices
- Regulation
- Consumer response
- Technological developments
- Competitor moves
- Climate defined as ‘crisis’
- Public pressure





Trans-Atlantic Differences in technology-political strategies

US Companies (Oil, Autos, Utilities, till ~ 2000)

Political: opposition to mandatory emission controls

- Emphasize high costs and uncertainty

Technological: - radical, showcase long-term investments

- incremental extension of existing technologies

European Companies:

Political: - accept science, negotiate, accommodate

- 140 g/km ACEA-EU agreement

Technological: investments in range of low-emission technologies

Market Context: Global Oil

- Firms face similar markets, resources, competencies

→ expect similar strategies **BUT** different political, market, cultural contexts

US firms:

- history of clean energy losses
- believe the Porter strategy story
- assume can stop regulation
- pessimistic regarding consumer change
- see world through US-centric lens

Euro firms:

- see regulation as inevitable
- optimistic that consumers adapt
- believe they can develop new competencies
- more international orientation

Trans-Atlantic Convergence 1999 to 2010

- participation in global industry, issue-level orgs.
- reactions to competitors
- firms develop global climate strategy teams
- formulate common political stance
- develop common outlook on markets
- diffusion of ‘win-win’ eco-modernist ideology
- collapse of GCC, rise of Pew
- strategic failures e.g. challenging climate science

Toward a Climate Compromise?

'Learn how being green can increase brand value and company profits'
Corporate Climate Response, 2007

- growth of clean energy economy
- carbon trading provides flexibility
- protects core business interests
- corp strategies consistent with weak, fragmented regime
- policymakers driven by 'competitiveness'
- flexible implementation, Enron style accounting?
- marginalizes more radical challenges to consumerism, business autonomy

Explosive Clean Tech Growth in Last Decade

Ten Years in Clean Tech: At a Glance

	2000	2010
Combined Global Market for Solar PV and Wind	$6.5 billion	$131.6 billion
Average Cost to Install a Solar PV System (Per Peak Watt)	$9	$4.82
Number of Hybrid Electric Vehicles on the Road in U.S.	Less than 10,000	More than 1.4 million
Number of Hybrid Electric Vehicle Models Available Globally	2	30
LEED-Certified Commercial Green Buildings in the World	3	8,138
Number of U.S. States with RPS	4	29
Percentage of Total U.S. Venture Capital Invested in Clean Tech	Less than 1%	More than 23%

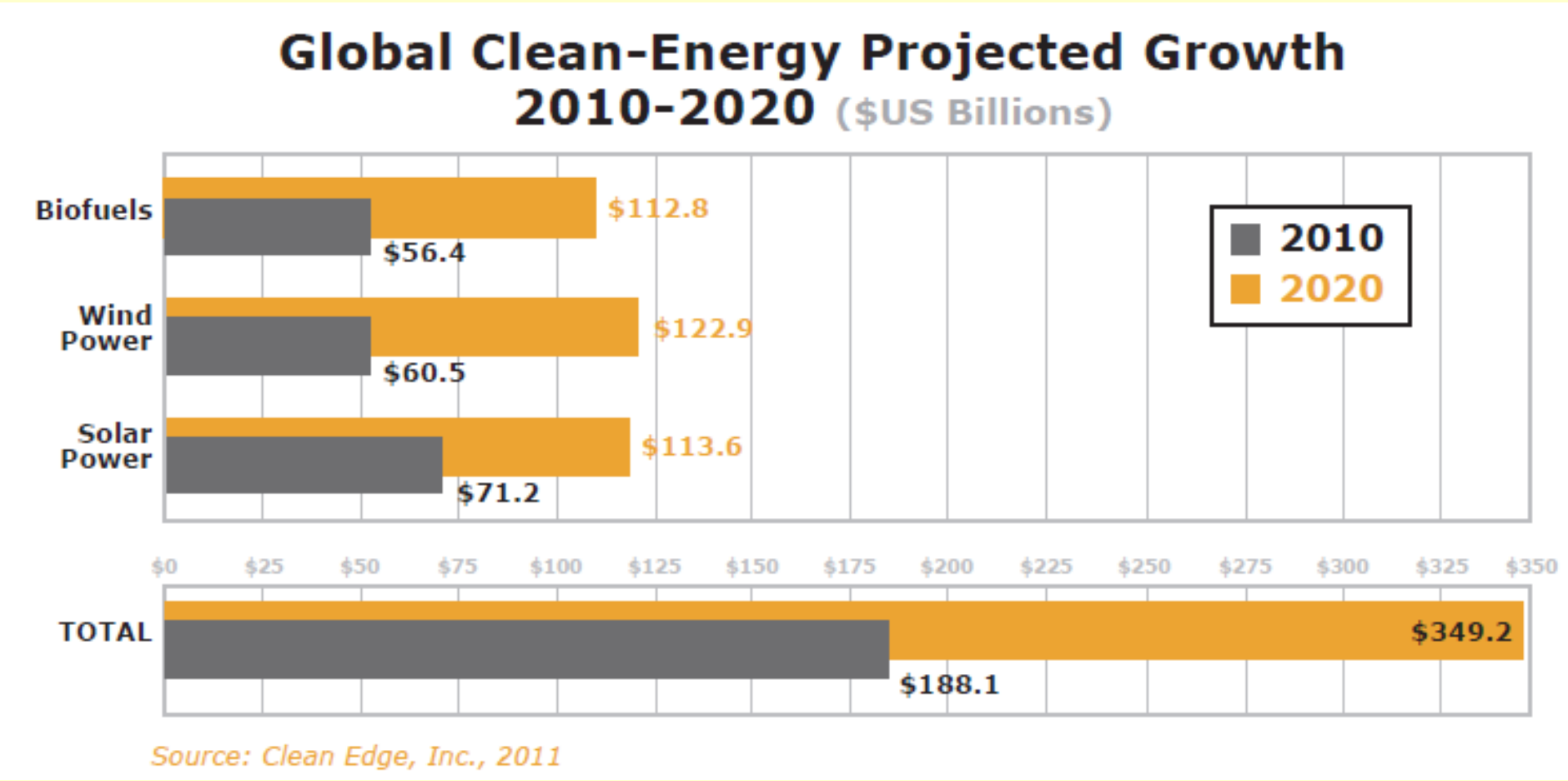
Source: Clean Edge, Inc., 2011

Global Clean-Energy Market Size 2000-2010

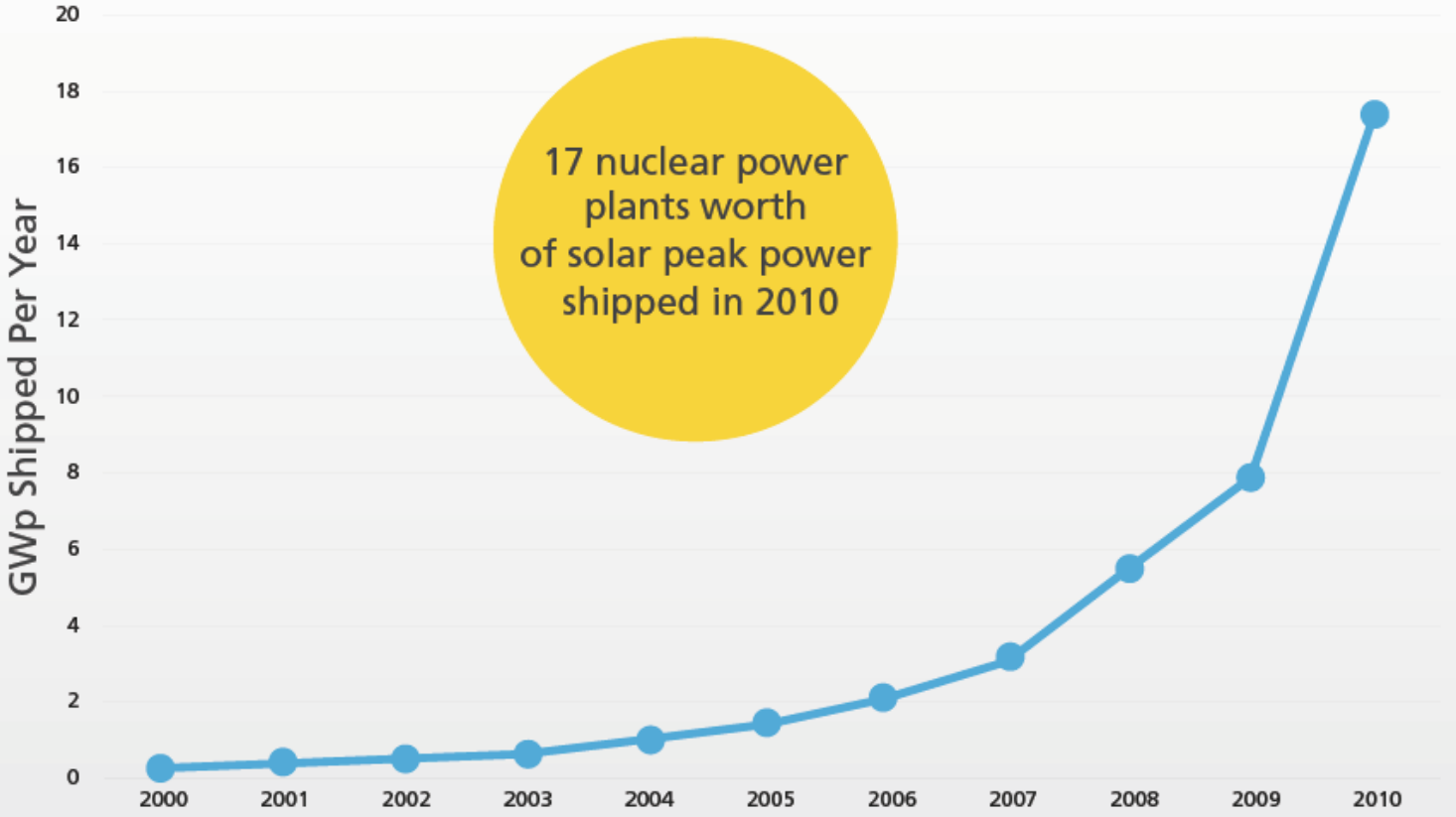
Year	Solar PV Global Market Size (in $Billions)	Wind Power Global Market Size (in $Billions)	Biofuels Global Market Size (in $Billions)
2000	$2.5	$4.0	N/A
2001	$3.0	$4.6	N/A
2002	$3.5	$5.5	N/A
2003	$4.7	$7.5	N/A
2004	$7.2	$8.0	N/A
2005	$11.2	$11.8	$15.7
2006	$15.6	$17.9	$20.5
2007	$20.3	$30.1	$25.4
2008	$29.6	$51.4	$34.8
2009	$36.1	$63.5	$44.9
2010	$71.2	$60.5	$56.4

Source: Clean Edge, Inc., 2011

Moderating Growth in Next Decade



Solar Growing Rapidly, Averaging 65% Compound Annual Growth Rate for the Past 5 Years



ndustry Growth Data from Paula Mints, Principal Analyst, Solar Services Program, Navigant

Clean Energy Business Models

- Value of storage, large grid networks, dispatchable and predictable power

- Monetizing ancillary benefits – grid congestion, cost of peak power, waste disposal

Venture Capital:

Seeds of growth, US Advantage

Clean-Tech Venture Capital Investments in U.S.-Based Companies as Percent of Total 2001-2010

Year	Total Venture Investments ($Millions)	Clean-Tech Venture Investments ($Millions)	Clean-Tech Percentage of Venture Total
2001	$37,624	$458	1.2%
2002	$20,737	$651	3.1%
2003	$18,789	$807	4.3%
2004	$21,699	$760	3.5%
2005	$22,535	$1,158	5.1%
2006	$26,010	$2,685	10.3%
2007	$29,901	$3,761	12.6%
2008	$28,105	$6,120	21.8%
2009	$18,276	$3,553	19.4%
2010	$21,823	$5,055	23.2%

Source: Cleantech Group, 2011, with Clean Edge analysis. Clean-tech venture investment includes seed funding and follow-on rounds prior to private equity activity related to stake acquisitions or buyouts. Investment categories include agriculture, air & environment, energy efficiency, energy generation, energy infrastructure, energy storage, materials, manufacturing/industrial, recycling & waste, transportation, and water & wastewater.

What's Hot, and What's Not?

- energy efficiency, measurement and management
- smart-grid, storage, power electronics, sensors
- high efficiency lighting
- NOT: scale mfg. of solar, batteries

New business models:

- multiple, short-term sources of value
  - convenience, savings, reputation, risk mgt.
- software, integrated services
- legal, professional, financial services

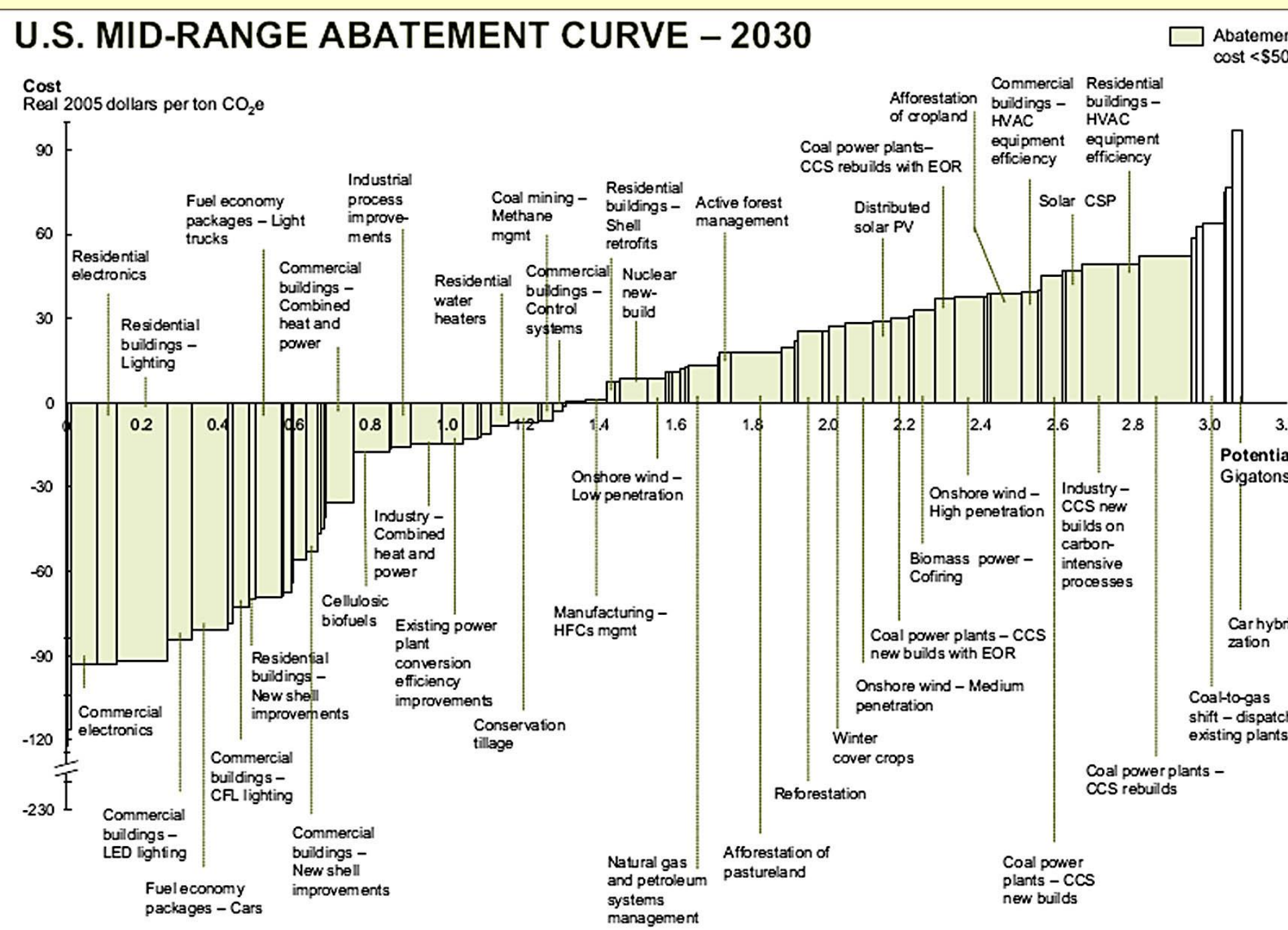
A123 SYSTEMS

AMERESCO
Green • Clean • Sustainable

better place

ENERNOC

U.S. MID-RANGE ABATEMENT CURVE – 2030



Source: McKinsey analysis

Barriers to low-carbon solutions

1. Upfront investment costs
2. Lack of knowledge/incentives/inertia
3. Uncertainty/measurement problems re benefits
4. Fragmented markets
5. Hidden costs – installation, transaction costs, monopolies
6. Split incentives – owner/bill payer, owner moving
7. Carbon lock-in: systemic solutions needed
8. Elevated hurdle rates (excessive ROI required)

Energy Efficiency

McKinsey 2009 Study of US:

Energy Savings $130 bn/year, $1.2 tn savings through 2020

Upfront investment of $520 bn needed

End-use demand reduced by 23% in 2020, 9 Quads.

Reduced GHG emissions of 1.1 GtC02e/year

By sector: end-use efficiency potential

Residential: 35%

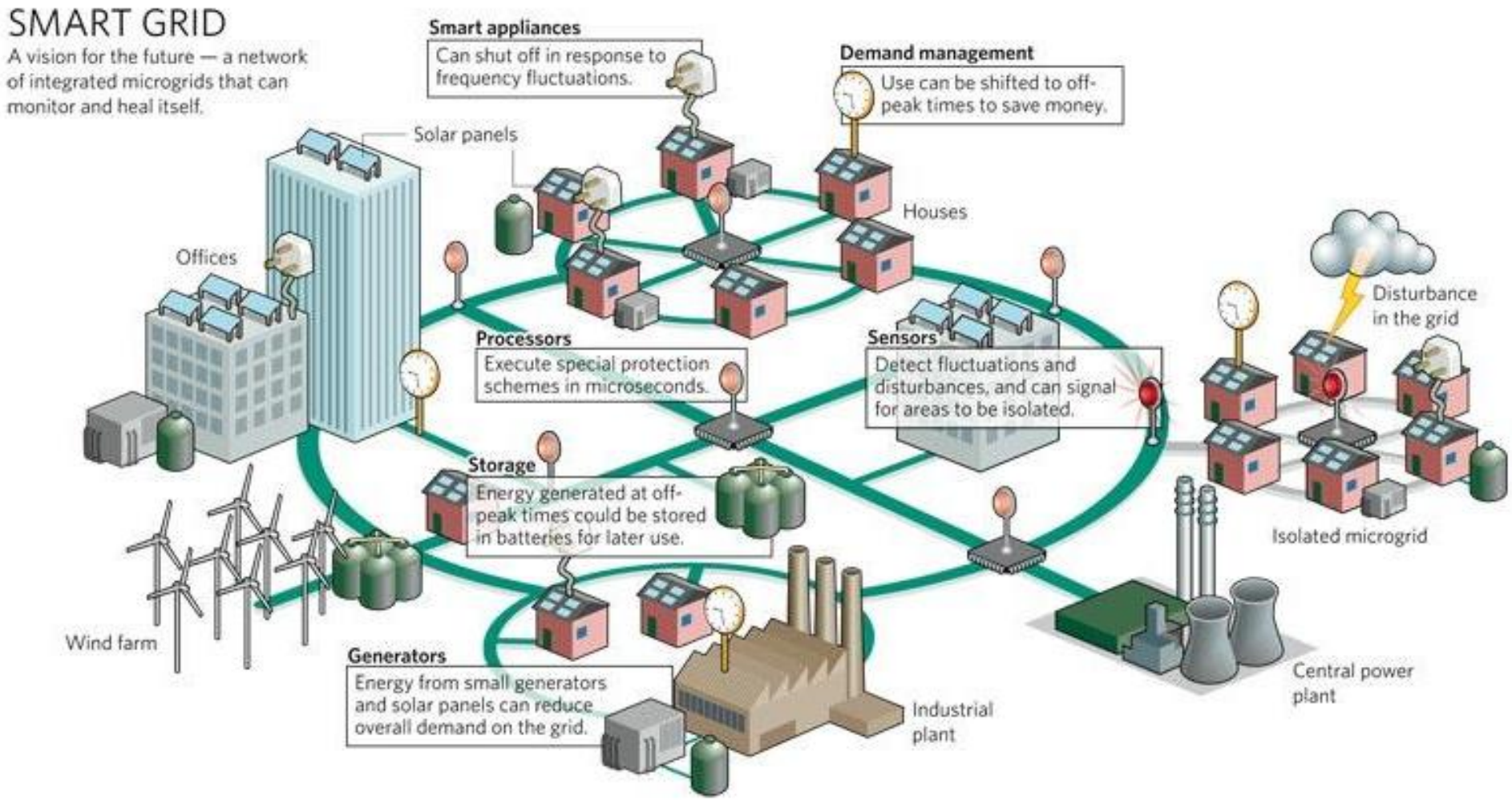
Industrial: 40%

Commercial: 25%

Smart Grid

Integrating decentralized, intermittent sources

Demand management, time-of-day pricing



Measuring and managing carbon is big business

- ESCO market to grow $5.6bn 2009 → $20bn 2020
- Enterprise Carbon Mgt software: Logica, EnerNOC, SAP etc.
- accounting, consulting, legal firms
- Walmart's supply chain initiative
- carbon trading

Carbon Software: $400m 2009
40% annual growth

Relevance of Carbon Information Systems

Multiple systems for diverse purposes

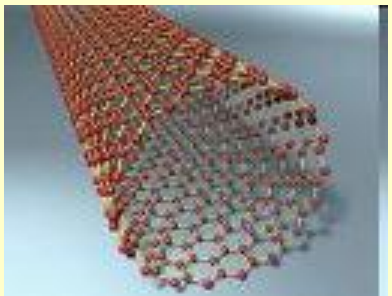
Carbon Disclosure Project: little value for carbon trading, cost control

Mandatory GHG reporting: preparation for trading, little mgt value

Carbon labeling: consumers confused, suppliers resistant,
reality of integrated value chain carbon mgt?

Enterprise Carbon Management Systems: immature, expensive,
needs aligning with cost acctg/mgt. systems





Measuring Carbon Risk?
No Simple Metrics for Investors

Who will win in solar? – crystalline silicon? thin film? thermal?

Compact fluorescents vs. LED lighting?

Which auto companies best positioned in hybrids, EVs?

Will A123 Systems win in car batteries?

Which oil company more exposed, BP or Exxon?

Green Jobs

770,000 in the US in 2007 - Pew
9.1% annual growth

14,400 Mass. Jobs

- 43% Energy Efficiency
- 28% Renewable Energy
- 28% Consulting & Support
- 1% University Research

Top 5 Sectors for Clean-Tech Job Activity (U.S.)

Rank	Sectors
1	Solar Power
2	Biofuels & Biomaterials
3	Smart Grid & Energy Efficiency
4	Wind Power
5	Advanced Transportation/Vehicles

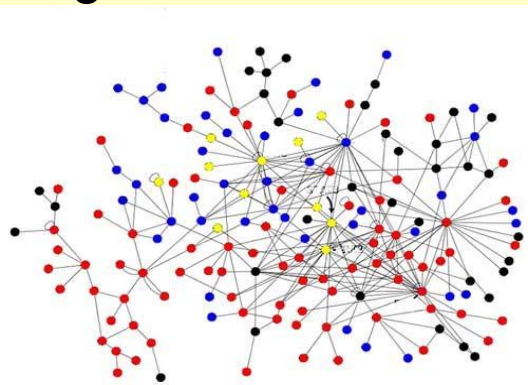
Source: Clean Edge, Inc., 2010

Northeast US Strategically Positioned to Benefit

Clean-tech business clusters:
Firms, Universities, Skills, Policies, Industry Assocs., NGOs, Venture Capital, Related Services

NorthEast has higher:

R&D per head in 10-State RGGI Region
Fed University Funding for Science and Engineering
SBIR Phase 1 Awards
Clean Energy business cluster concentration
Labor force skills



Clean-Tech Job Activity – Top 15 U.S. Metro Areas

Rank	Metro Area
1	San Francisco-Oakland-San Jose, CA
2	Los Angeles-Long Beach-Riverside, CA
3	Boston-Cambridge-Quincy, MA-NH
4	New York-Northern New Jersey-Long Island, NY-NJ
5	Denver-Aurora-Broomfield, CO
6	Washington-Arlington-Baltimore, DC-VA-MD
7	San Diego-Carlsbad-San Marcos, CA
8	Houston-Sugar Land-Baytown, TX
9	Chicago-Joliet-Naperville, IL-IN-WI
10	Austin-Round Rock-San Marcos, TX
11	Seattle-Tacoma-Bellevue, WA
12	Atlanta-Sandy Springs-Marietta, GA
13	Dallas-Fort Worth-Arlington, TX
14	Portland-Vancouver-Hillsboro, OR-WA
15	Sacramento–Arden-Arcade–Roseville, CA

Top 10 Clean-Tech Employers (Publicly Traded Pure Plays)

Rank	Company	Headquarters	Sector/Activity	Employees
1	Vestas Wind Systems	Randers, Denmark	Wind	20,730
2	LDK Solar	Xinyu, China	Solar	13,464
3	Suntech Power Holdings	Wuxi, China	Solar	12,548
4	Itron	Liberty Lake, WA	Smart Grid	9,000
5	China BAK Battery	Shenzhen, China	Energy Storage	8,200
6	Trina Solar	Changzhou, China	Solar	7,891
7	Baldor Electric Company	Fort Smith, AR	Electric Motors	7,250
8	Gamesa Corpora-cion Tecnologica	Vitoria, Spain	Wind	6,721
9	Neo-Neon Holdings	Hong Kong	LED Lighting	6,505
10	Yingli Green Energy	Baoding, China	Solar	5,813

Source: Clean Edge, Inc., 2010