Innovation as imperative to sustainable development: meeting the new challenges

Frederick M. Abbott
Professor of Law, Florida State University
President, Nova Worldwide Consulting
Belém, Brazil -- June 22, 2009

Basis of Demand for Sustainable Energy Generation

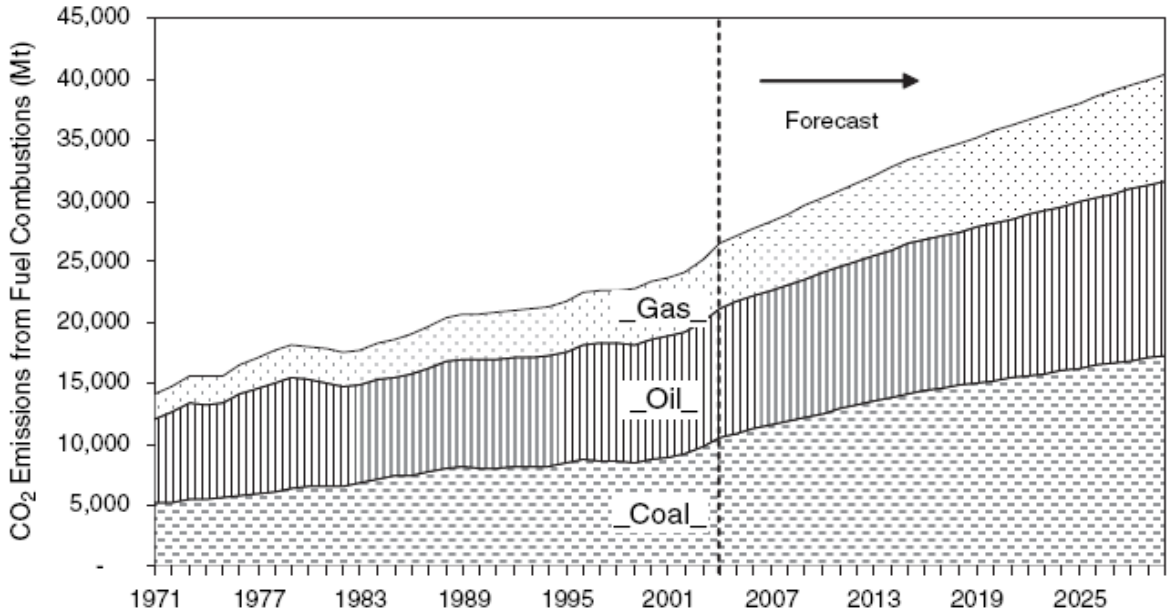
- Climate Change primary political driver with evidence of global warming based on CO2 emissions generally accepted
  - Warnings issuing from diverse sources
    - International Energy Agency : Preventing catastrophic and irreversible damage to the global climate ultimately requires a major decarbonisation of the world energy sources. On current trends, energy-related emissions of carbon dioxide (CO2) and other greenhouse gases will rise inexorably, pushing up average global temperature by as much as 6° C in the long term. Strong, urgent action is needed to curb these trends. (World Energy Outlook 2008)

Other imperatives

- Costs of energy supply represent a major burden for most countries, and particularly for developing countries lacking substantial petroleum deposits
- Hydrocarbon resource mining and production often presents direct risks to environment and human health
- National economies highly dependent upon extractive industries appear prone to political distortions because of wealth concentration
  - Volatility in energy commodity prices has caused significant difficulties in government planning
- Importance of diversifying energy sources apparent since early 1970s

Present and forecast CO2 emissions by fuel type

Figure 1. Historical and Forecasted CO_2 Emissions from Fuel Combustions by Fuel Type

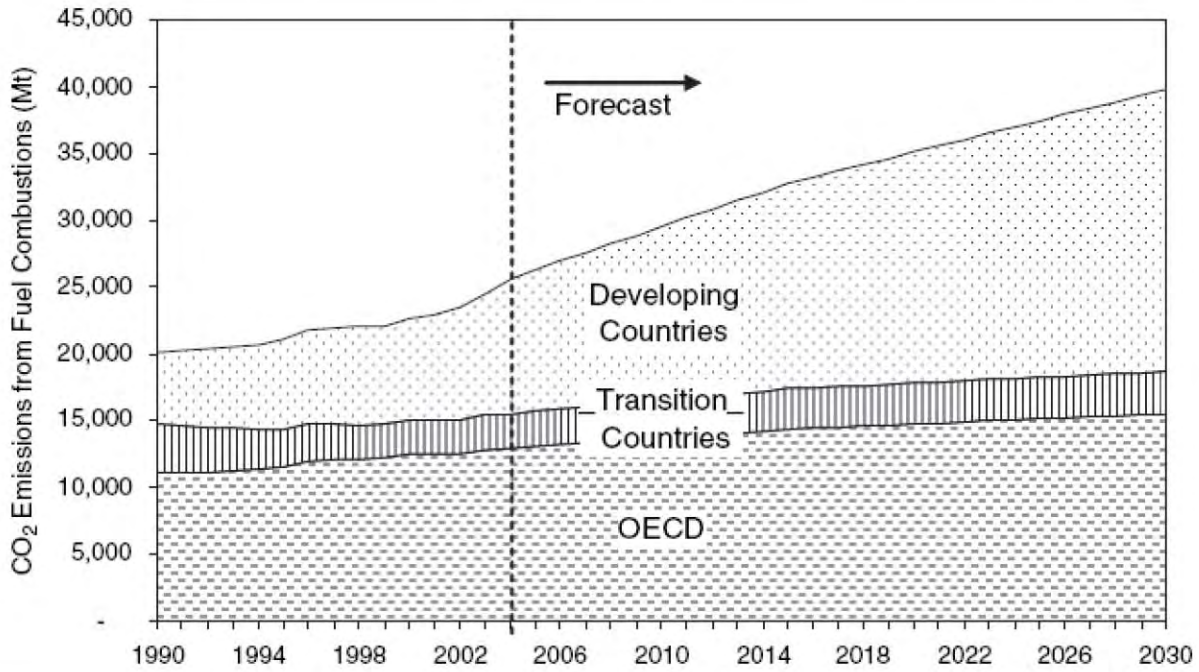


Source: Adapted from IEA 2006b and 2007a.

World Bank – accelerating clean energy technology research, development and deployment 2008

Shifting pattern of CO_2 emissions by region

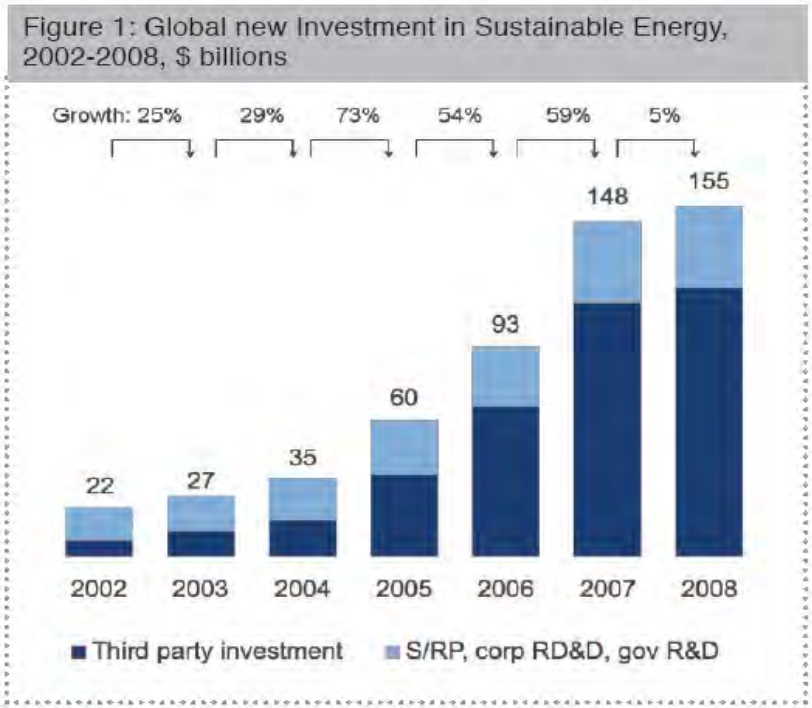
Figure 2. Historical and Forecasted CO_2 Emissions from Fuel Combustions by Region



Source: Adapted from IEA 2006b and 2007a.

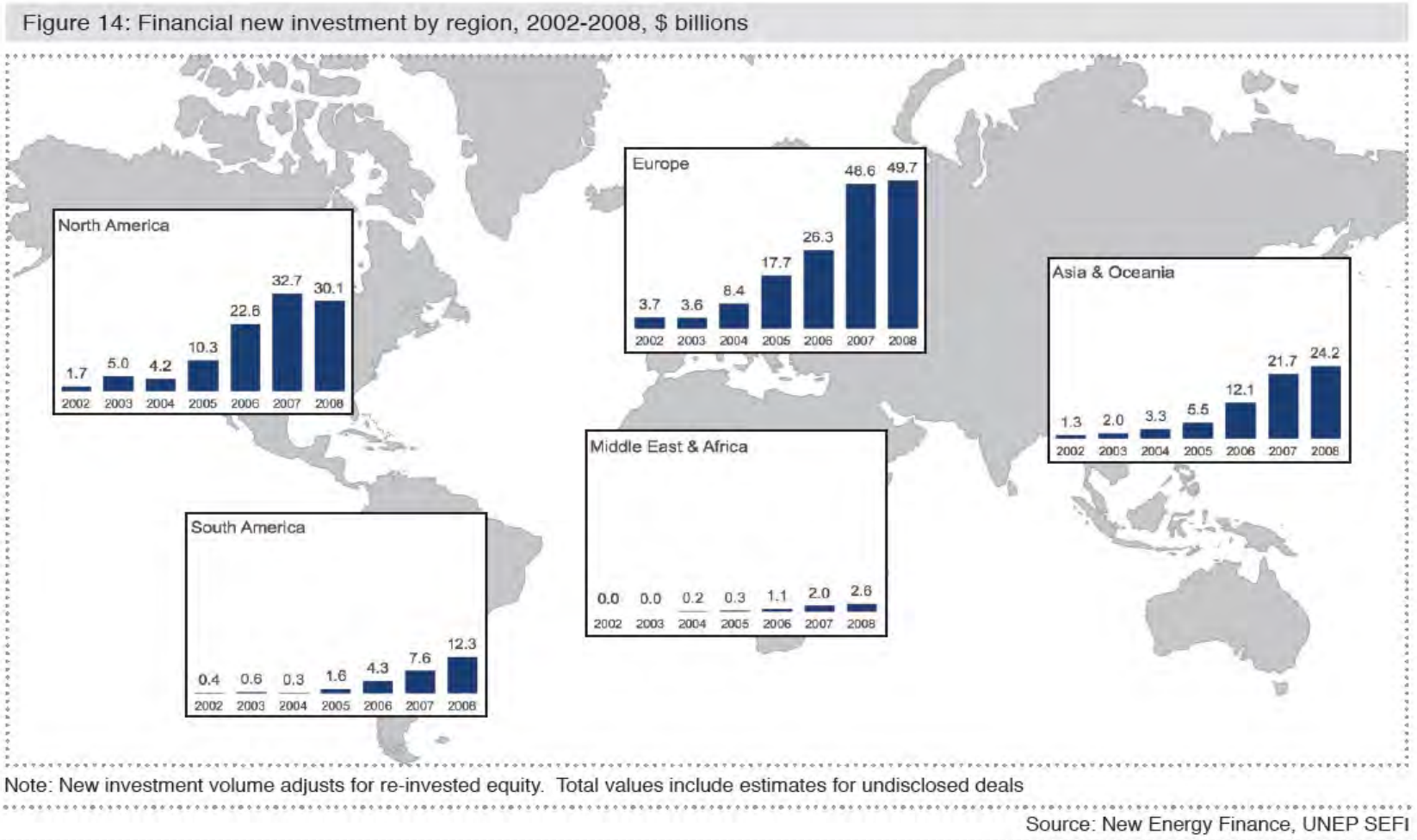
World Bank 2008

Trends in green energy investment



UNEP-SEFI-NEF Global trends in sustainable energy investment 2009

Green energy investment by region



UNEP-SEFI-NEF Global trends in sustainable energy investment 2009

Renewable energy capacity

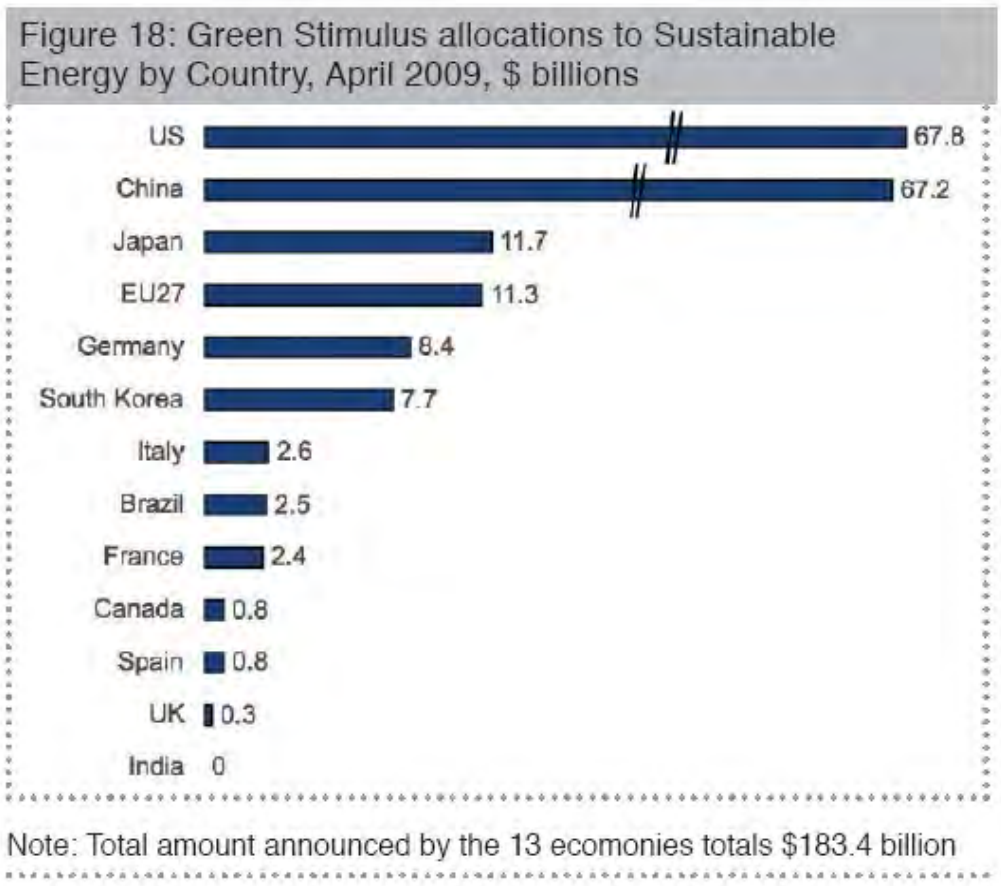
Figure 17. Renewable Energy Added and Existing Capacities, 2008 (estimated)

	Added during 2008	Existing at end of 2008
Power Generation(GW)		
Large hydropower	25-30	860
Wind power	27	121
Small hydropower	6-8	85
Biomass power	2	52
Solar PV, grid-connected	5.4	13
Geothermal power	0.4	10
Concentrating solar thermal power (CSP)	0.06	0.5
Ocean (tidal power)	~ 0	0.3
Hot water/heating (GWth)		
Biomass heating	n/a	~ 250
Solar collectors for hot water/ space heating	19	145
Geothermal heating	n/a	~ 50
Transport fuels (billion litres/year)		
Ethanol production	17	67
Biodiesel production	3	12

Source: REN21 Renewables Global Status Report 2009 Update

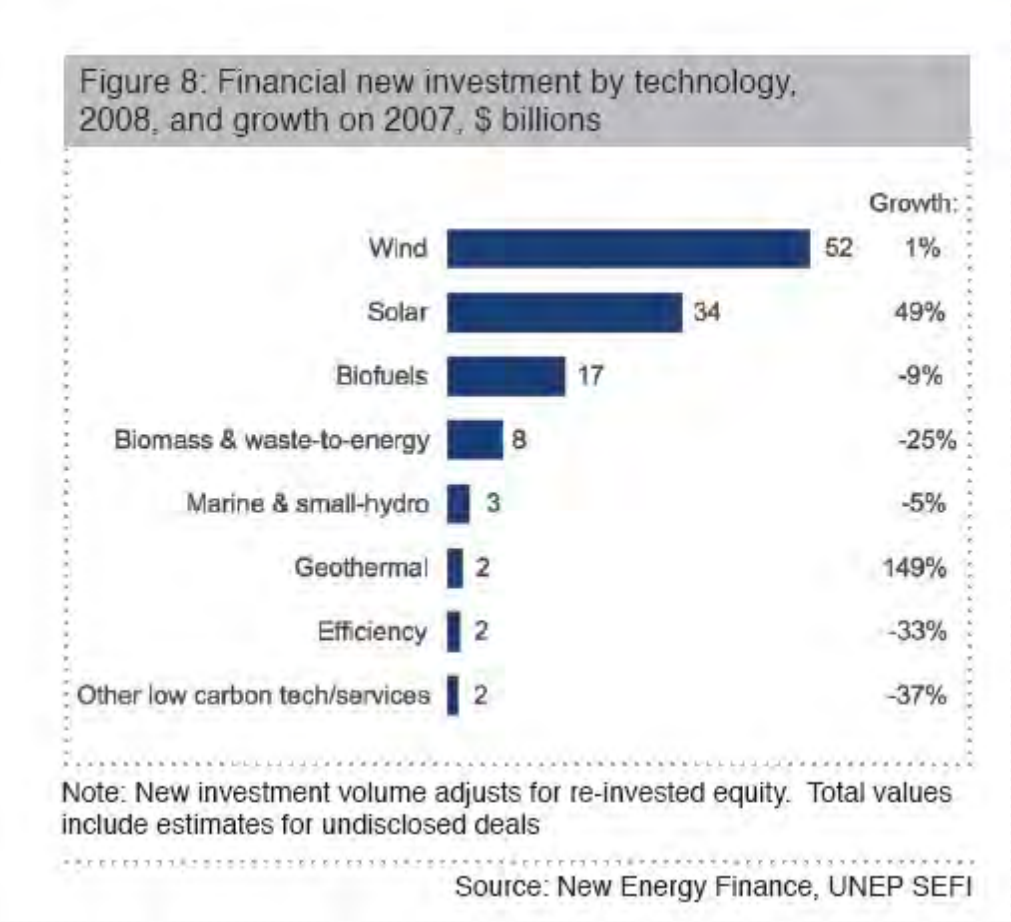
UNEP-SEFI-NEF Global trends in sustainable energy investment 2009

Government stimulus funding 2009



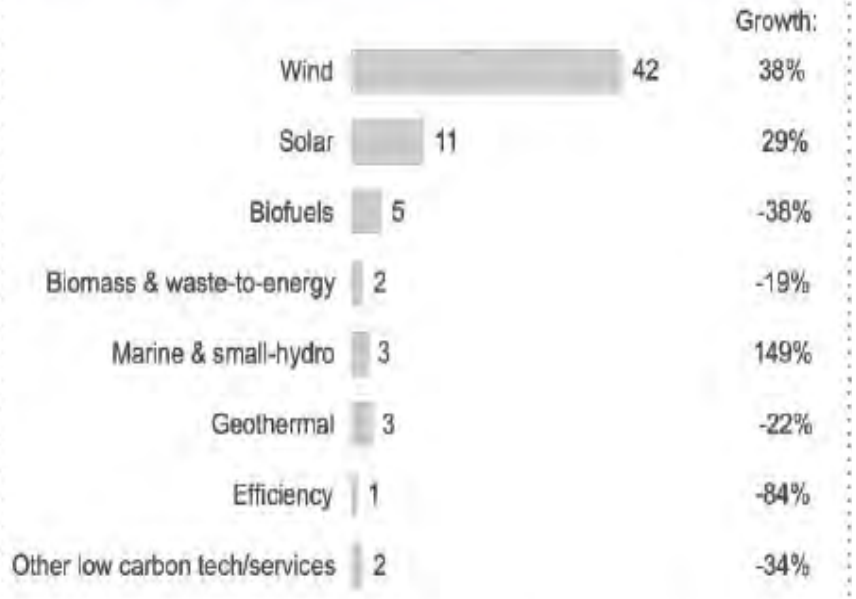
UNEP-SEFI-NEF Global trends in sustainable energy investment 2009

Where is investment in green energy generation going?



Where is investment in green energy generation going?

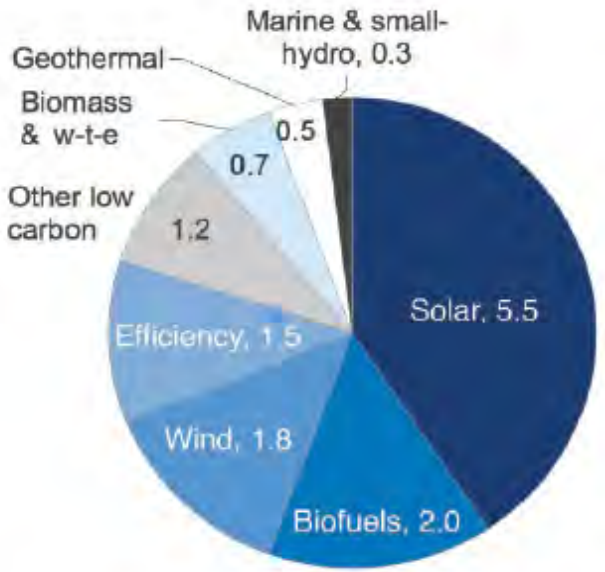
Figure 9: Acquisition transactions by technology, 2008, and growth on 2007, $ billions



Note: Total values include estimates for undisclosed deals

Source: New Energy Finance, UNEP SEFI

Figure 10: VC/PE new investment by technology, 2008, $ billions (Total = $13.5 billion)



Note: VC/PE new investment excludes PE buy-outs. Total values include estimates for undisclosed deals

Source: New Energy Finance, UNEP SEFI

Brazil as a green energy market

- "Brazil is the world's largest renewable energy market, thanks to hydropower and its long-established ethanol sector which has thrived alongside the country's sugarcane industry. 46% of the country's energy comes from renewable sources, and 85% of its power generation capacity. Large hydro provides four-fifths of the country's electricity (see Figure 50)."
- "Brazil accounted for almost all renewable energy investment in Latin America in 2008. Total financial investment in Brazil was $10.8 billion, an increase of 76% on 2007. Ethanol continues to dominate investment in Brazil, representing 70% of new renewables investment in the country."

UNEP-SEFI-NEF Global trends in sustainable energy investment 2009

Brazil's green energy capacity

Brazil

Figure 50: Installed Renewable Energy Capacity and Targets in Brazil

	2007 Capacity	2008 Capacity	2012 Capacity
Large Hydro	72.9GW	73.6GW	80.8GW
Small Hydro	3.5GW	3.8GW	11.5GW
Wind	247MW	359MW	1.5GW
Solar PV	8.6MW	8.6MW	8.6MW
Solar Water Heating	560MW	600MW	786MW
Biomass Power	4.1GW	4.8GW	8GW
Biogas	41.6MW	41.6MW	41.7MW
Bioethanol	22bn litres	25bn litres	25% of all gasoline consumption
Biodiesel	2.6bn litres	3.4bn litres	5% of diesel consumption

Note: Small hydro 2007/8 capacity includes all less than 50MW

Source: New Energy Finance, Brazilian Government (mainly Ministry for Mines & Energy)

UNEP-SEFI-NEF Global trends in sustainable energy investment 2009

Obama Administration

- "The American Recovery and Reinvestment Act included more than $60 billion in clean energy investments that will jump-start our economy and build the clean energy jobs of tomorrow:
  - $11 billion for a bigger, better, and smarter grid that will move renewable energy from the rural places it is produced to the cities where it is mostly used, as well as for 40 million smart meters to be deployed in American homes.
  - $5 billion for low-income home weatherization projects.
  - $4.5 billion to green federal buildings and cut our energy bill, saving taxpayers billions of dollars.
  - $6.3 billion for state and local renewable energy and energy efficiency efforts.
  - $600 million in green job training programs – $100 million to expand line worker training programs and $500 million for green workforce training.
  - $2 billion in competitive grants to develop the next generation of batteries to store energy. "

  (http://www.whitehouse.gov/issues/energy_and_environment/,visited June 16, 2009)

Obama Administration

- "Invest in Climate-Friendly Energy Development and Deployment: Invest $150 billion over the next ten years to enable American engineers, scientists and entrepreneurs to advance the next generation of biofuels and fuel infrastructure, accelerate the commercialization of plug-in hybrids, promote development of commercial-scale renewable energy, and begin the transition to a new digital electricity grid. This investment will transform the economy and create 5 million new jobs."

  (http://www.whitehouse.gov/agenda/technology, visited April 25, 2009)

Mechanisms to promote innovation

- Patents and other forms of intellectual property
  - Patent provides economic reward in form of market exclusivity for a limited time in exchange for disclosure of invention
  - Generally places risk of loss on private sector and leaves selection of 'direction of research' to investor
  - Method of 'securitizing' innovation facilitating allocation to best use through licensing, transfer, etc.
  - Social welfare costs in the form of increased prices and limited access to technology for patent term
- As "smart grid" technology is developed copyright as protective mechanism for computer software takes on increasing importance for green energy sector
  - Copyright has substantially different characteristics than patent in terms of longer duration, exclusion of function from protection and possibilities for non-infringing 'workaround'

Mechanisms to promote innovation

- Subsidies are government grants that may be directed to R&D. Governments have relied substantially on subsidies to promote innovation in certain fields, including those with 'public goods' characteristics where private investment may not otherwise flow. Military technologies, space exploration, vaccine development, etc.
- Subsidies have advantage of targeting specific results and may involve selection of particular technological approaches
- Traditional critique of subsidies directed at capacity of 'government bureaucrats' to make appropriate decisions, and potential encouragement of waste and delay by subsidy recipients
  - Mechanisms are available to overcome potential drawbacks, including use of independent scientific assessment boards, and benchmarking in subsidies contracts
- Energy sector traditionally reliant on government subsidization of new technologies, e.g., nuclear energy in 1950s and forward, because of scale of necessary investment and risk. 'Green energy' transition heavily subsidized.

Bayh-Dole trend

- Historical problem of incentivizing translation of basic research into commercialized products motivated United States industrial policy makers to authorize private recipients of public R&D funding to secure patents on inventions, with limited restrictions and possibility for intervention by government (Bayh-Dole Act and related legislation)
- Combines R&D subsidy incentive mechanism with private market commercialization/profit incentive
- Trend in other countries including Brazil is to adopt Bayh-Dole approach to solve the innovation-translation problem, although specifics vary as to government role. India presently debating legislation.

Mechanisms to promote innovation

- Public health debates led push to develop new forms of incentive mechanism
  - Renewed attention to 'prizes' - more complex than simple winner takes all formulas
  - Public-private partnerships (PPPs) in which inputs into R&D process come from diverse sources and outputs may be allocated differentially across markets and/or income groups
  - 'Pull' incentives in form of advanced purchase commitments that assure market for products (mainly used in vaccine field)
  - Promotion of patent pooling (e.g., UNITAID)
- Learning curve from public health debates useful for informing Climate Change dialog
- Open network (or open source) innovation, developed more in context of software, can and does play a significant role in the innovation process

Innovation policy

- Innovation policy with respect to addressing Climate Change is being formulated at the multilateral, regional, national and local levels
- National governments remain the primary drivers of energy policy because of powers to tax and spend
  - Multilateral institutions are dependent on contributions and voluntary cessions of sovereign authority
  - Investments in innovation typically represent a combination of private sector and government initiative

Innovation policy constraints

- International intellectual property rules establish a minimum set of obligations with respect to providing rights to inventors, both domestic and foreign
- World Trade Organization (WTO) TRIPS Agreement establishes basic substantive norms for patent, trademark, copyright, trade secret, design and other IP forms
  - Also establishes enforcement standards and forum for state-to-state dispute settlement
- World Intellectual Property Organization (WIPO) establishes complementary substantive standards and mechanisms for facilitating grant of patents and trademarks in multiple jurisdictions (PCT and Madrid systems)
- Negotiations in both forums proceeding on a wide variety of issues, though in all cases 'slowly'
- WTO rules are largely friendly to R&D subsidies, but prohibit such subsidies when targeting export markets (see Airbus-Boeing disputes)

Controversy over IP effects

- In the public health arena these IPRs rules have generated significant controversy because of the impact on access to medicines, particularly within developing countries
- It is currently much debated whether these rules will have the same impact on access to technologies needed to prevent and mitigate Climate Change

Working hypothesis

- It is generally accepted among economists and industrial policy specialists that patents play a particularly significant role in the pharmaceutical sector because of a combination of high R&D costs and low reverse engineering and production costs.
- Working hypothesis -- strongly promoted by clean energy industry (e.g., General Electric) -- is that innovation market in energy production is significantly less subject to “bottlenecks” based on patents

Basis of working hypothesis

- Energy essentially a fungible commodity available from a wide range of sources
  - Compare novel therapeutic treatment available from a single source
- Foundational technologies relevant to clean energy generation already discovered

Hydro	**Biomass (including ethanol, biodiesel, etc)**
Solar	**Geothermal**
Wind	**Tidal**
Nuclear	

Basis of working hypothesis

- Innovation in the clean energy sector will be "incremental"
  - No single invention will be capable of blocking field
- Risks from anticompetitive conduct greater than risk from intellectual property rules
- See John H. Barton, *Intellectual Property and Access to Clean Energy Technologies in Developing Countries: An Analysis of Solar Photovoltaic, Biofuel and Wind Technologies*, ISCTSD Trade and Sustainable Energy Series, Issue Paper No. 2, Dec. 2007

Assumption that no one will invent a breakthrough technology that will transform energy generation industry obviously "suspect" -- we cannot know what we do not know -- but we do know that we do not know everything!

United Nations Framework Convention on Climate Change

- Includes mandate to develop policies and programs on transfer of technology in favor of developing countries
- Has established Expert Group on Technology Transfer
- Little progress has been made toward developing concrete proposals or commitments
- Developing countries and NGOs have focused substantial attention on intellectual property issues, including proposal to adopt a 'Doha Declaration' on Intellectual Property and Climate Change
- Predictably developed country IP-holder industries have reacted by forming coalitions to lobby against weakening IP standards

Some suggestions regarding a Declaration

- Debate should be 'evidence-based' to the extent feasible
- Experts recognize that TRIPS Agreement and other international IP agreements provide substantial flexibility for governments to overcome IP barriers
  - Compulsory and government use licensing, limited exceptions and flexibility to apply competition law
  - Main (serious) constraints are political
  - At recent Brasilia conference celebrating 200 years of intellectual property law in Brazil, national experts acknowledged that a major part of Brazil's problem with TRIPS was based on flawed domestic implementation
- Progressive development of international law may benefit from an IP and Climate Change Declaration, but not at the expense of developing tangible transfer of technology programs

Practical solutions

- Green energy technology is primarily controlled by the private sector, not by governments (except through potential power of intervention)
- The private sector is motivated by potential for commercial gain, but this by no means excludes forming joint ventures that create mutual benefit
- Energy infrastructure projects are well-suited to developmental joint ventures because projects typically must be situated near energy users
- Developing country governments should focus on establishing favorable terms of trade in energy projects that include transfer of technology. Developing country governments should place pressure on multilateral institutions such as World Bank to include transfer of technology obligations in project financing agreements.

National innovation policy and IP

- The grant of intellectual property protection is an important aspect of private sector capital formation and efficient allocation of technology. Even public sector institutions require means to securitize their investments in innovation in order to bargain with private sector and peer institutions.
- Inability to return investment on innovation likely to lead to underinvestment in innovation
- Patent systems also encourage certain forms of 'bad behavior' because higher than competitive market returns on investment are difficult to relinquish
- The role of government is to police the innovation and technology transfer market to assure that opportunities for exploiting misconduct are limited

IP and innovation policy challenges ahead

- Taking USA as illustration, very large-scale public investment being made in new energy generation and distribution technologies. So far, government has not adopted specific frameworks for protection of and access to technologies developed under new programs.
  - Should new automotive green technologies be placed into pool? How would access to pool be determined? Would pooling requirement inhibit innovation?
  - Should of the Department of Energy place specific conditions on recipients of large-scale federal funding in terms of making new technologies available?
- Assuming government proposes access to new technologies, would it seek to regulate access to innovation based on national identity of receiving party?
  - National preferences in access to technology may not 'as such' contravene WTO rules unless linked to some other form of discriminatory preference, such as preferential procurement rules (in some cases) or export targeting

IP and innovation policy challenges ahead for Brazil

- Brazil currently appears at leading edge in technologies for ethanol production. Conceptually could become reliant on foreign innovation and face royalty demands. More likely Brazil will be exporter of ethanol-related technology and should attend to its international patent portfolio as new technologies emerge.
- Similar issues may arise in context of new biotechnologies applicable to biomass conversion. Brazil is both technology exporter and importer.
- Because Brazil has good fortune of abundant hydro-resources, may focus on technologies of energy distribution, including 'smart grid' software and hardware. Here foreign source suppliers are heavily investing and Brazil will either need to keep pace or import these technologies. This appears as good area for government support of innovation activity. Patents and copyrights both are important in this field.