National Renewable Energy Laboratory
Innovation for Our Energy Future

Renewable Energy – Moving Technologies into the Marketplace

Swedish American Entrepreneurial Day

Dan E. Arvizu
Laboratory Director
April 7, 2008

Mounting Evidence

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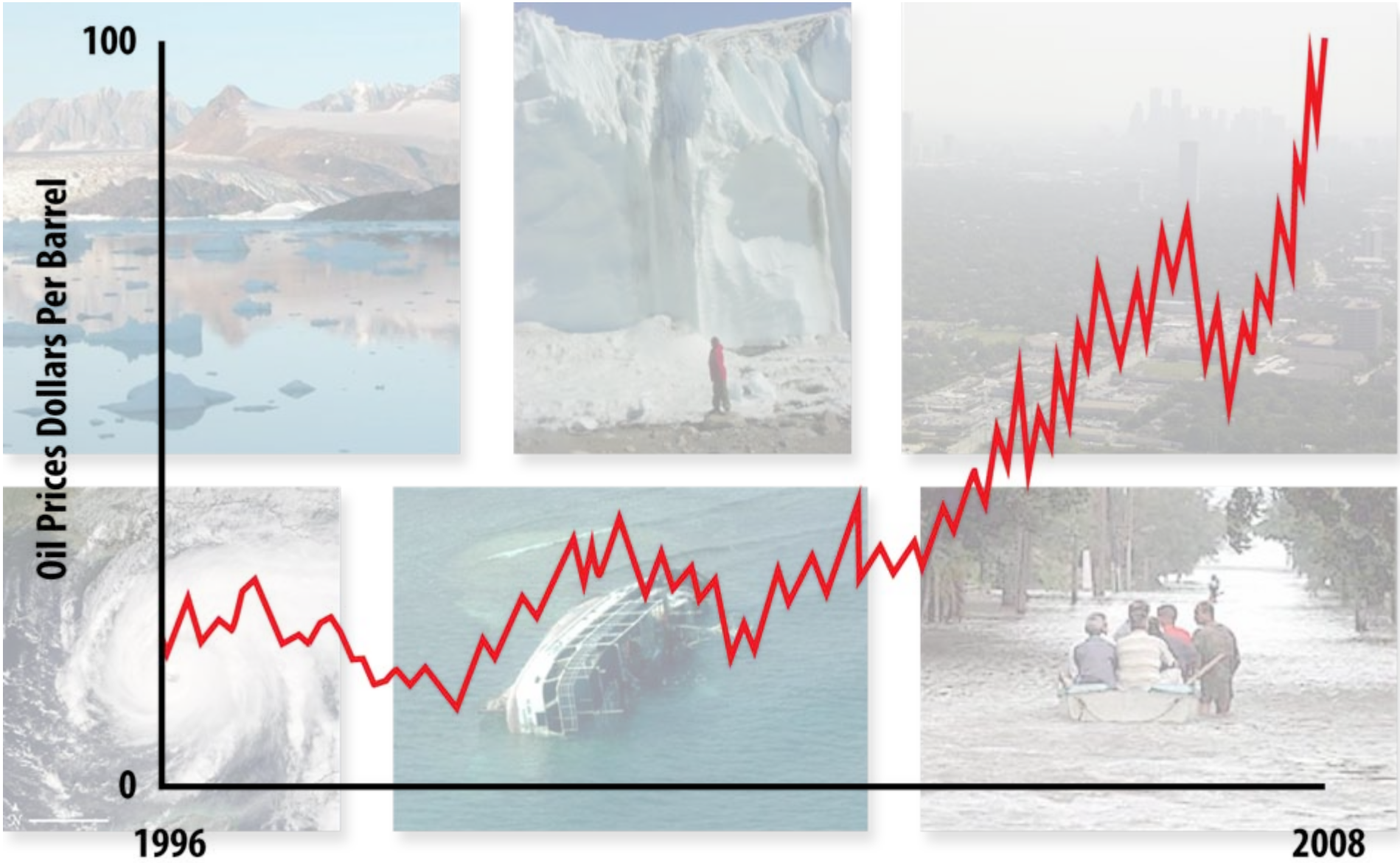
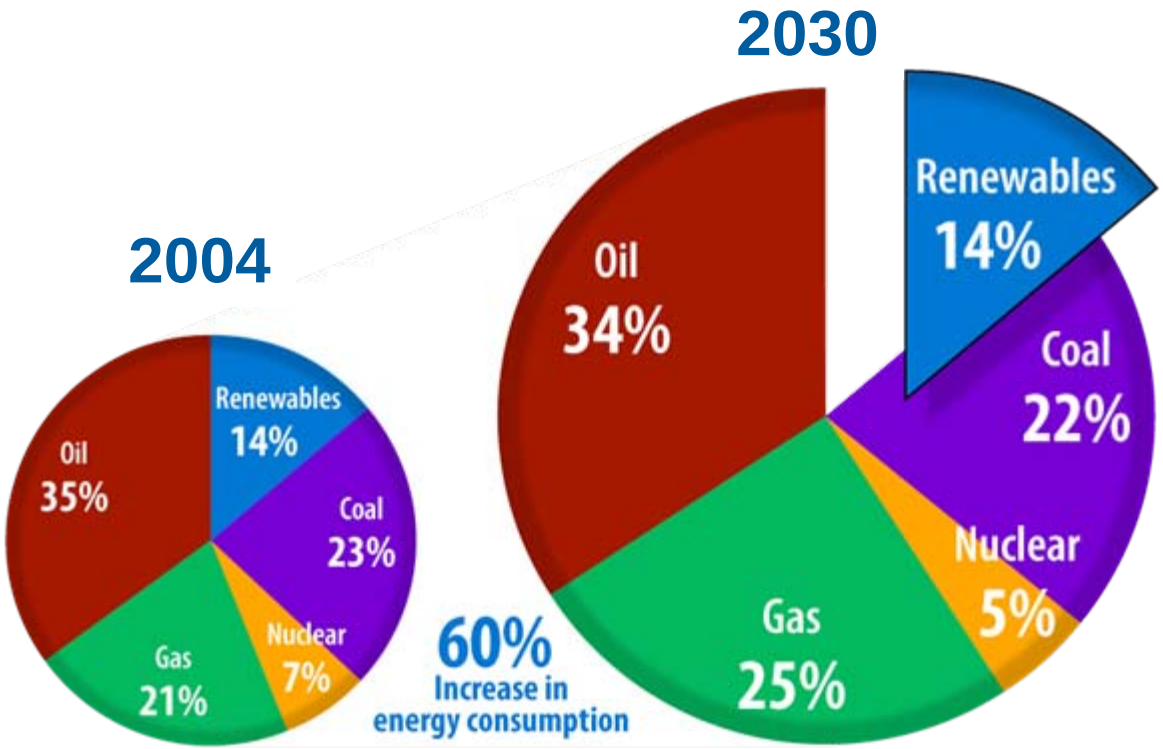


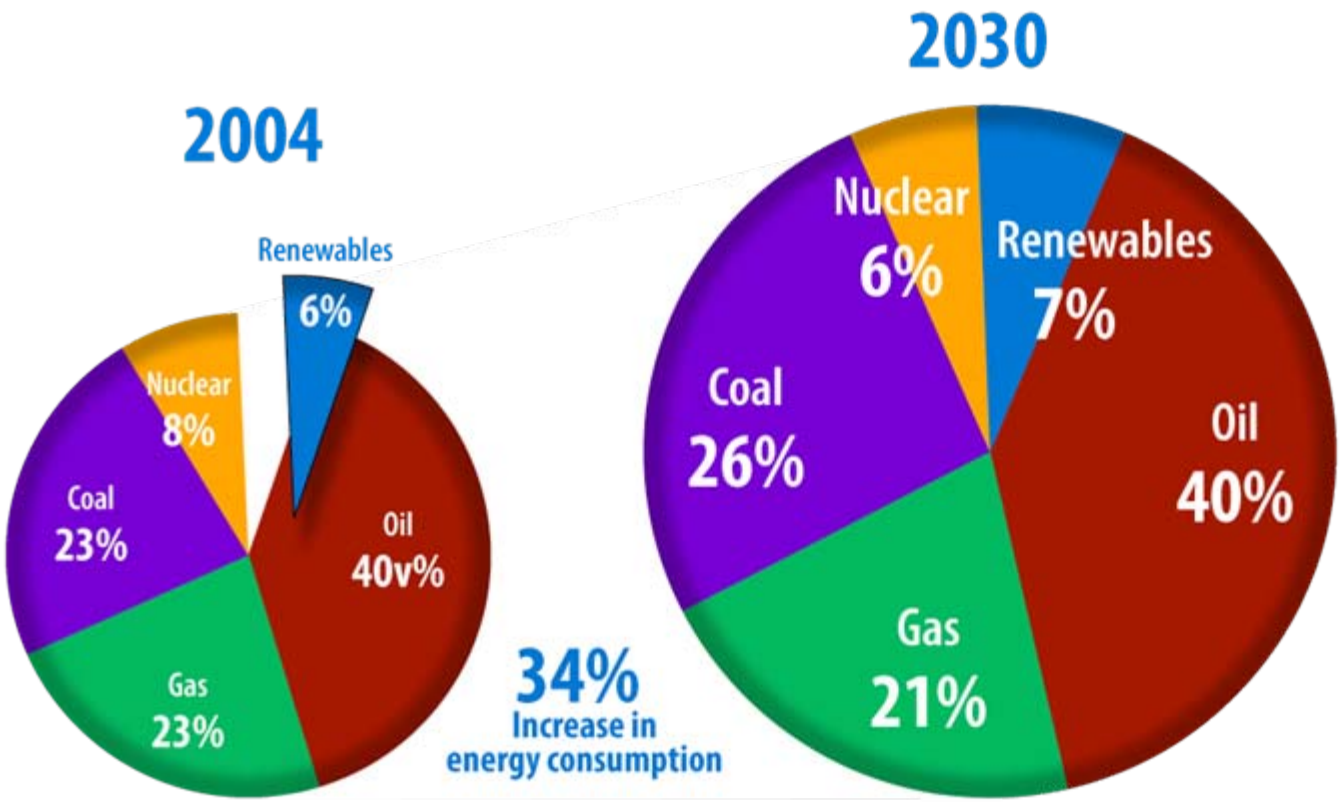
World Energy Supply and the Role of Renewable Energy



Source: IEA/OECD, World Energy Outlook 2007

Table: Reference Scenario: World, p. 592

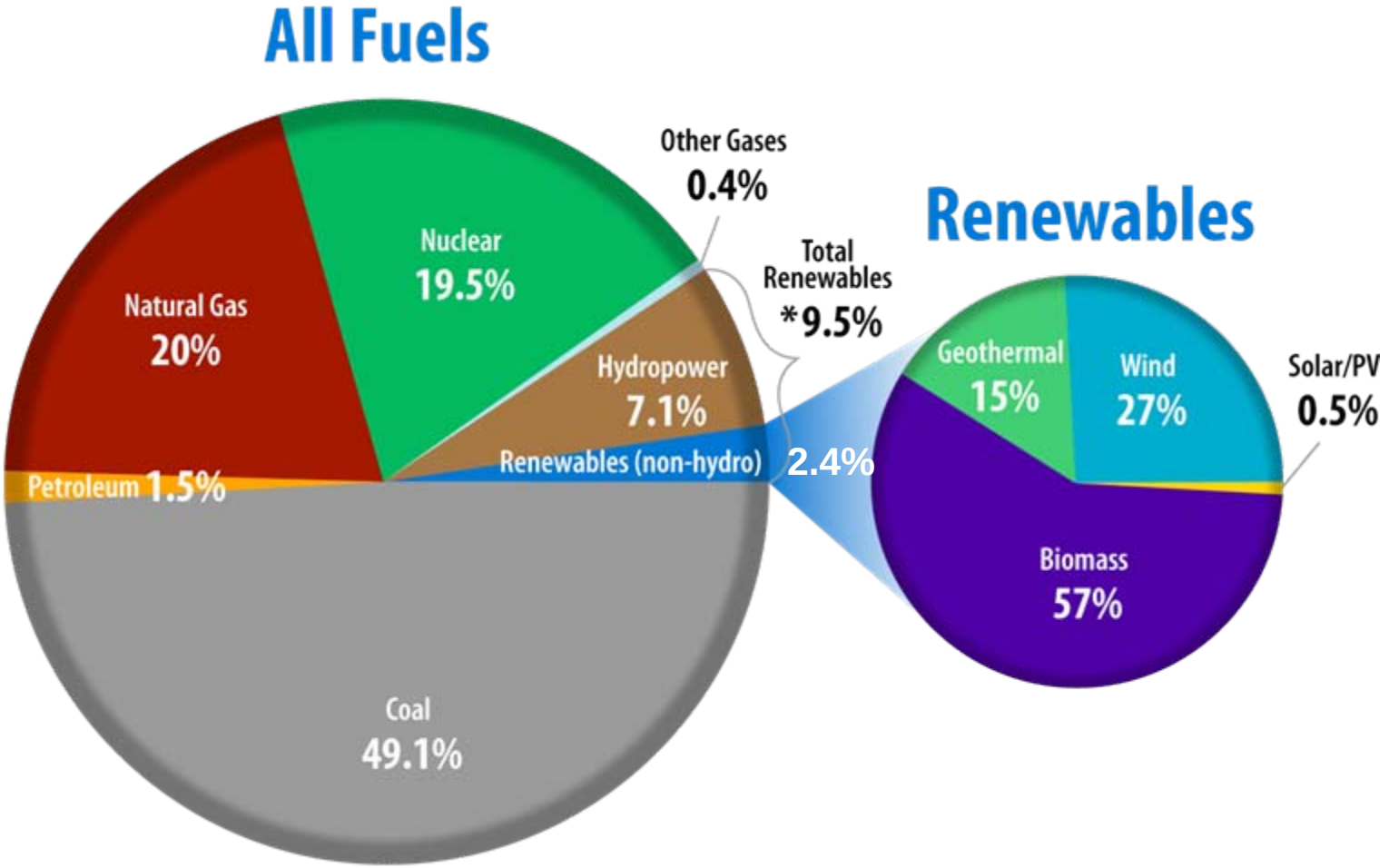
U.S. Energy Consumption and the Role of Renewable Energy



Source: Energy Information Administration, *Annual Energy Outlook 2006,* Table D4

What Are the Major Renewables?

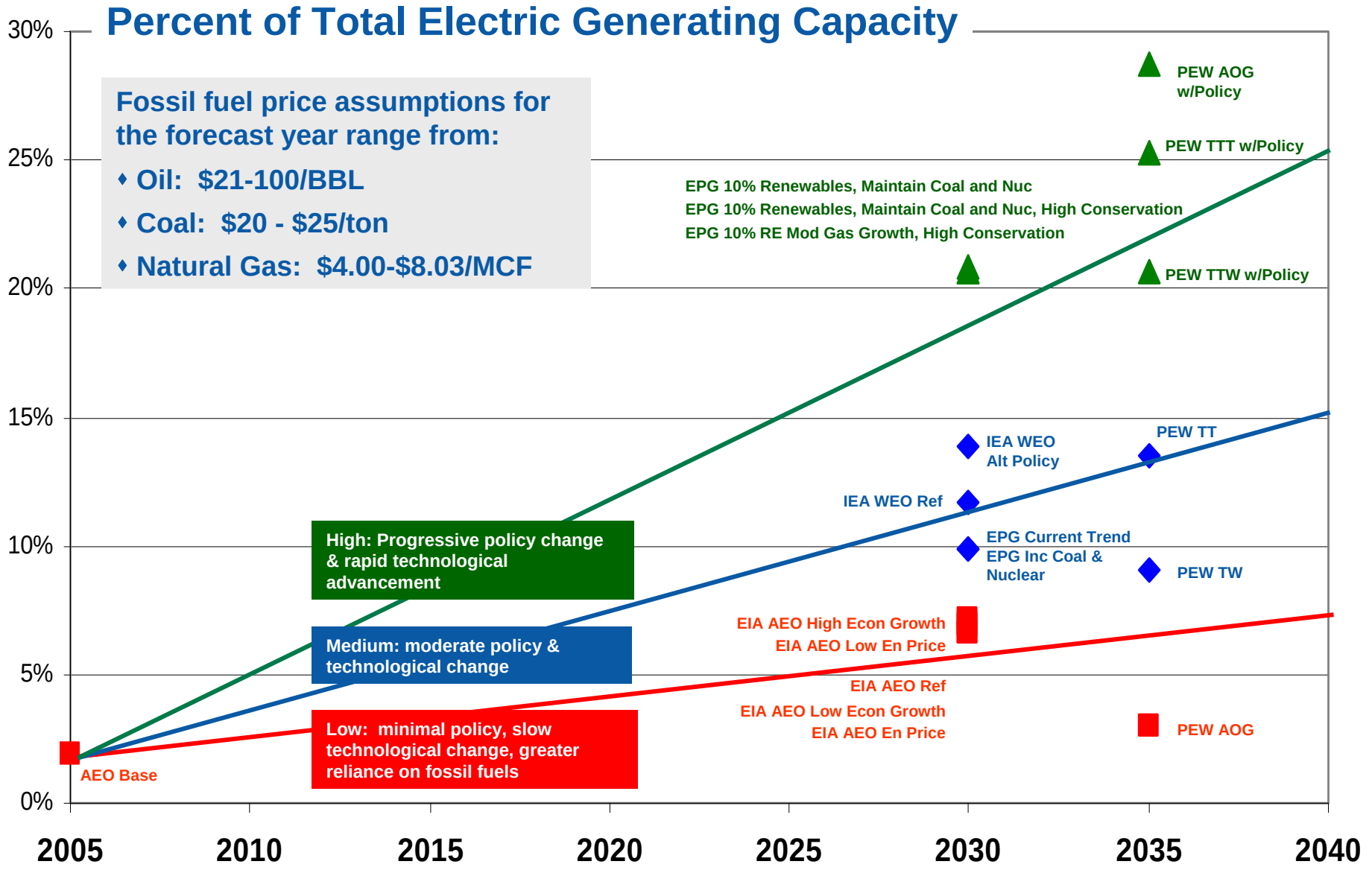
U.S. Electricity Net Generation



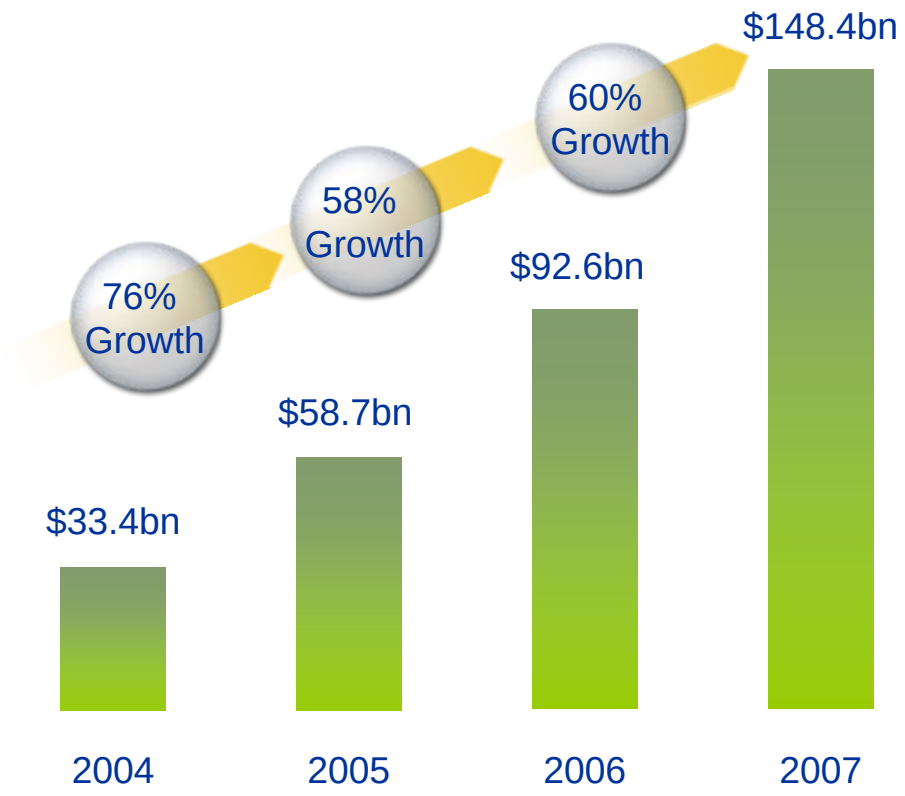
Net generation for 2006

Source: EIA Annual Energy Review 2007

U.S. Renewable Energy Contributions



Global New Investment in Clean Energy



1% of global fixed asset investment

10.5% of global energy industry infrastructure investment

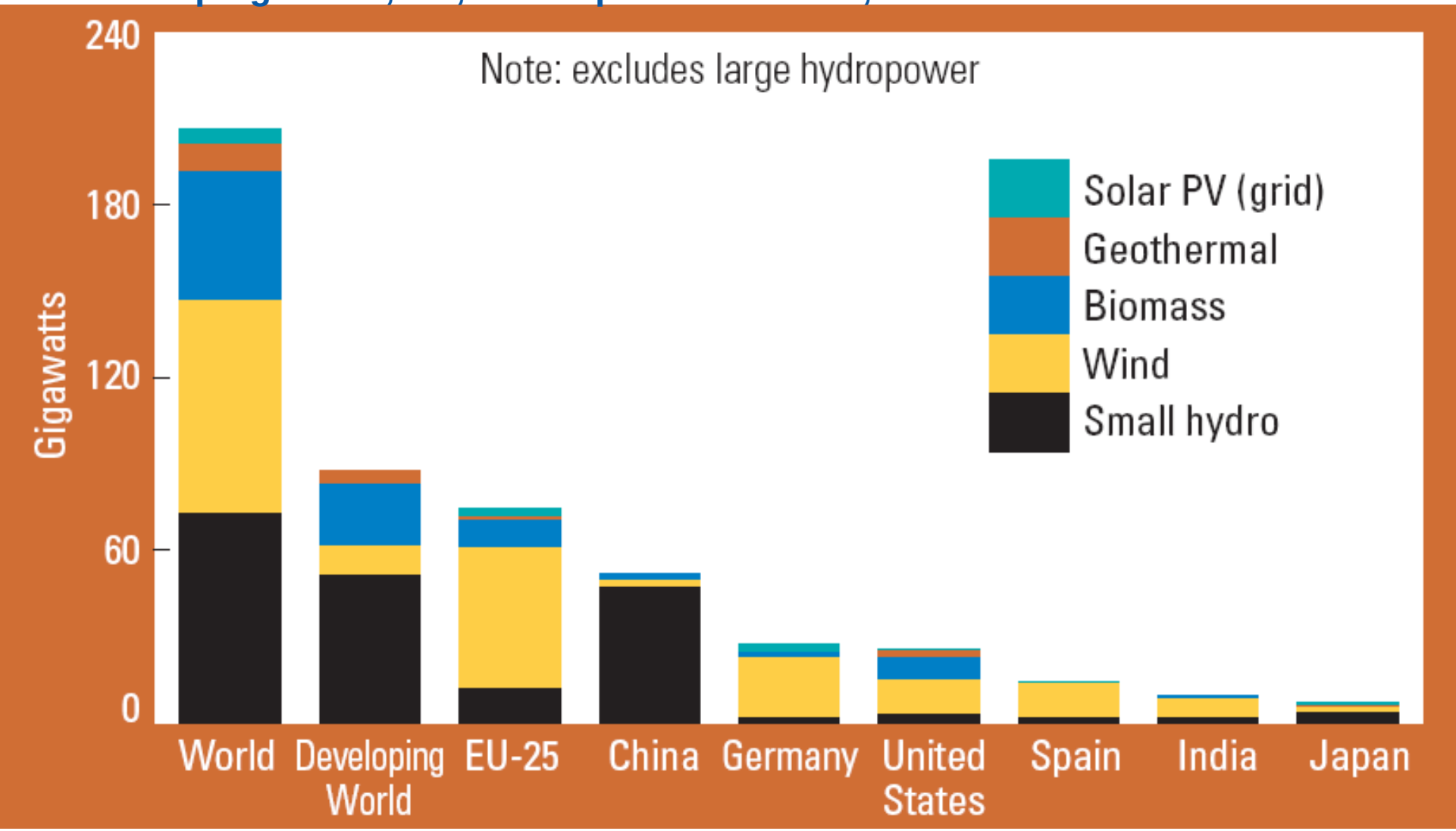
2.5 times the size of commercial aircraft investment sector

Source: New Energy Finance, IMF WEO Database, IEA WEO 2007, Boeing 2006 Annual Report

Adjusted for reinvestment. Geared re-investment assumes a 1 year lag between VC/PE/Public Markets funds raised and re-investment in projects.

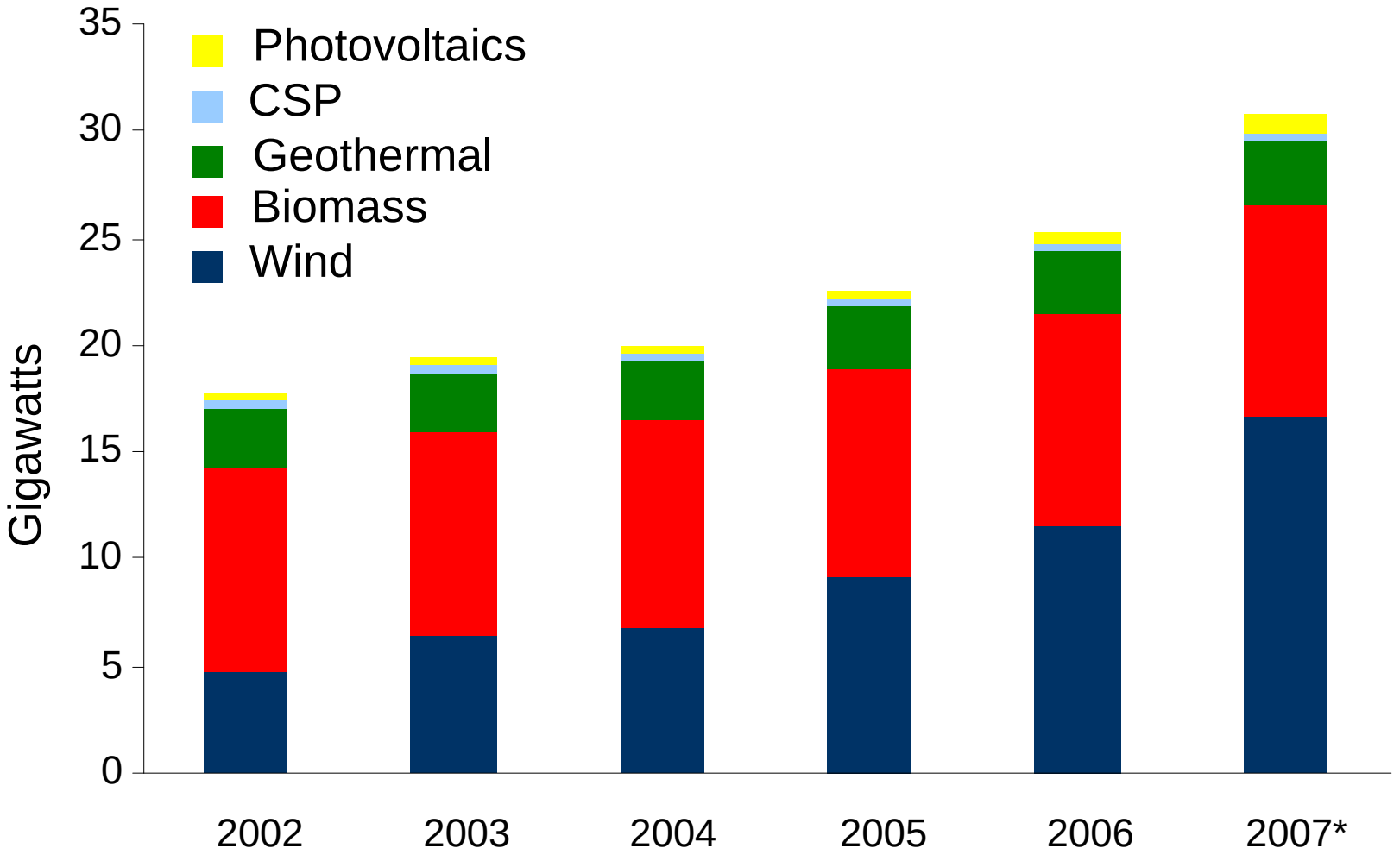
Global Renewable Electricity Capacity

Developing World, EU, and Top Six Countries, 2006



Source: REN21 2007 Global Status Report

U.S. Renewable Electricity Capacity



Installed Nameplate
Sources: Chalk, AWEA, IEA, NREL, EIA, GEA

Technology Development Programs

NREL R&D Portfolio

Efficient Energy Use

- Vehicle Technologies
- Building Technologies
- Industrial Technologies

Renewable Resources

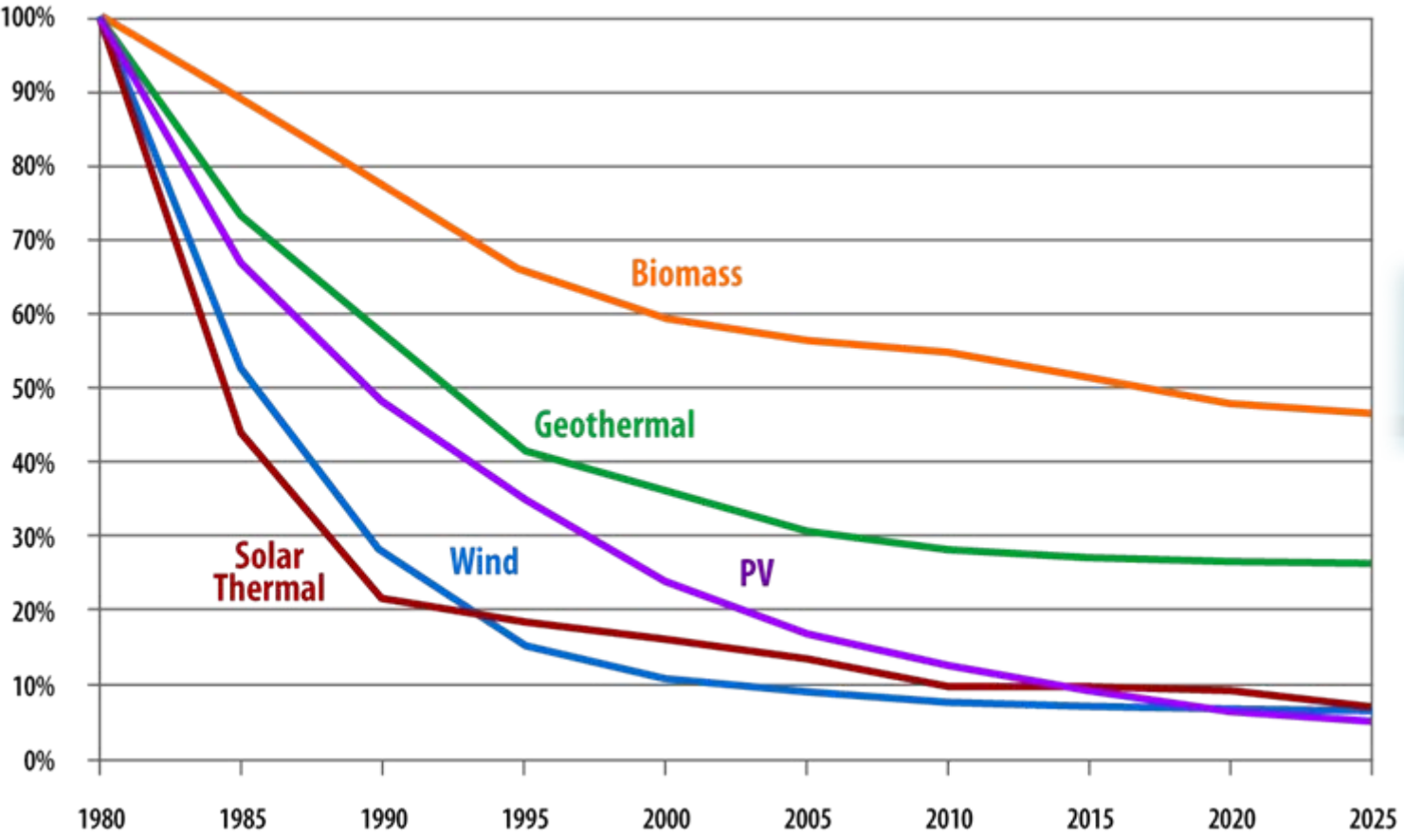
- Wind
- Solar
- Biomass
- Geothermal

Energy Delivery and Storage

- Electricity Transmission and Distribution
- Alternative Fuels
- Hydrogen Delivery and Storage

Foundational Science and Advanced Analytics

Innovation—Past Investments Have Dramatically Reduced Costs



Wind

Today's Status in U.S.

- 16,850 MW installed at end of 2007
- Cost 6-9¢/kWh at good wind sites*

DOE Cost Goals

- 3.6¢/kWh, onshore at low wind sites by 2012
- 7¢/kWh, offshore in shallow water by 2014

Long Term Potential

- 20% of the nation's electricity supply

NREL Research Thrusts

- Improved performance and reliability
- Advanced rotor development
- Utility grid integration

* With no Production Tax Credit
Updated March 12, 2008
Source: U.S. Department of Energy, American Wind Energy Association

Photovoltaics and Concentrating Solar Power

Status in U.S.

PV
- 824 MW
- Cost 18-23¢/kWh

CSP
- 419 MW
- Cost 12¢/kWh

Potential:

PV
- 11-18¢/kWh by 2010
- 5-10 ¢/kWh by 2015

CSP
8.5 ¢/kWh by 2010
6 ¢/kWh by 2015

NREL Research Thrusts:

PV
- Partnering with industry
- Higher efficiency devices
- New nanomaterials applications
- Advanced manufacturing techniques

CSP
- High performance, low cost storage for baseload markets
- Advanced absorbers, reflectors, and heat transfer fluids
- Next generation solar concentrators

Source: U.S. Department of Energy, IEA
Updated January 28, 2008

Biofuels

Current Biofuels Status

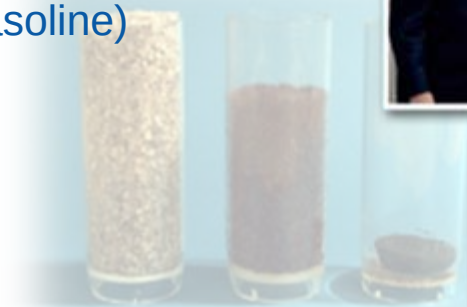
- Biodiesel – 165 companies; 1.85 billion gallons/yr capacity[1]
- Corn ethanol
  - 134 commercial plants[2]
  - 7.2 billion gal/yr. capacity[2]
  - Additional 6.2 billion gal/yr planned or under construction
- Cellulosic ethanol (current technology)
  - Projected commercial cost ~$3.50/gge

Key DOE Goals

- 2012 goal: cellulosic ethanol $1.31/ETOH gallon or ~$1.96/gge
- 2022 goal: 36B gal Renewable Fuel; 21B gal "Advanced Renewable Fuel"– 2007 Energy Independence and Security Act
- 2030 goal: 60 billion gal ethanol (30% of 2004 gasoline)

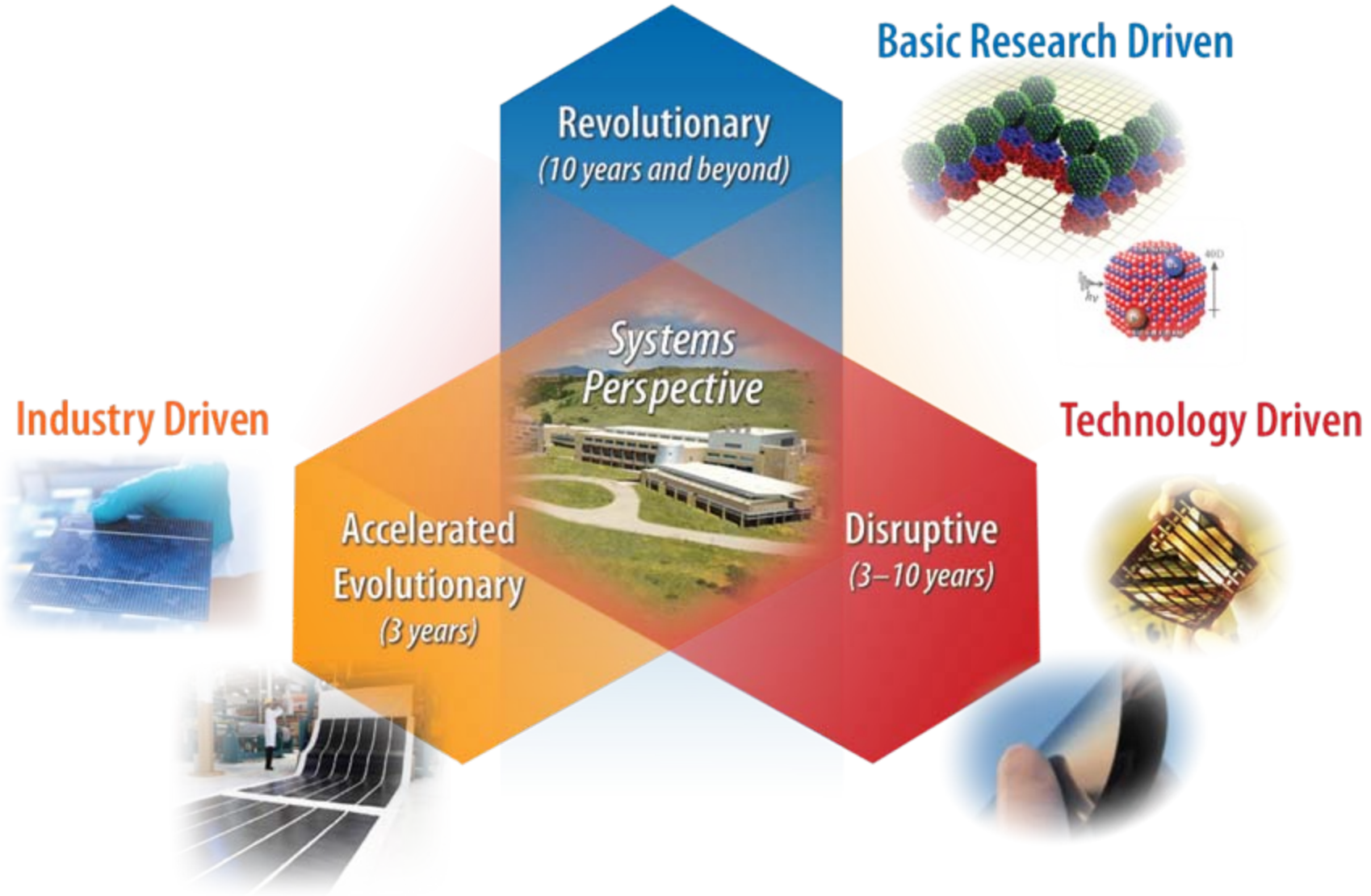
NREL Research Thrusts

- The biorefinery and cellulosic ethanol
- Solutions to under-utilized waste residues
- Energy crops



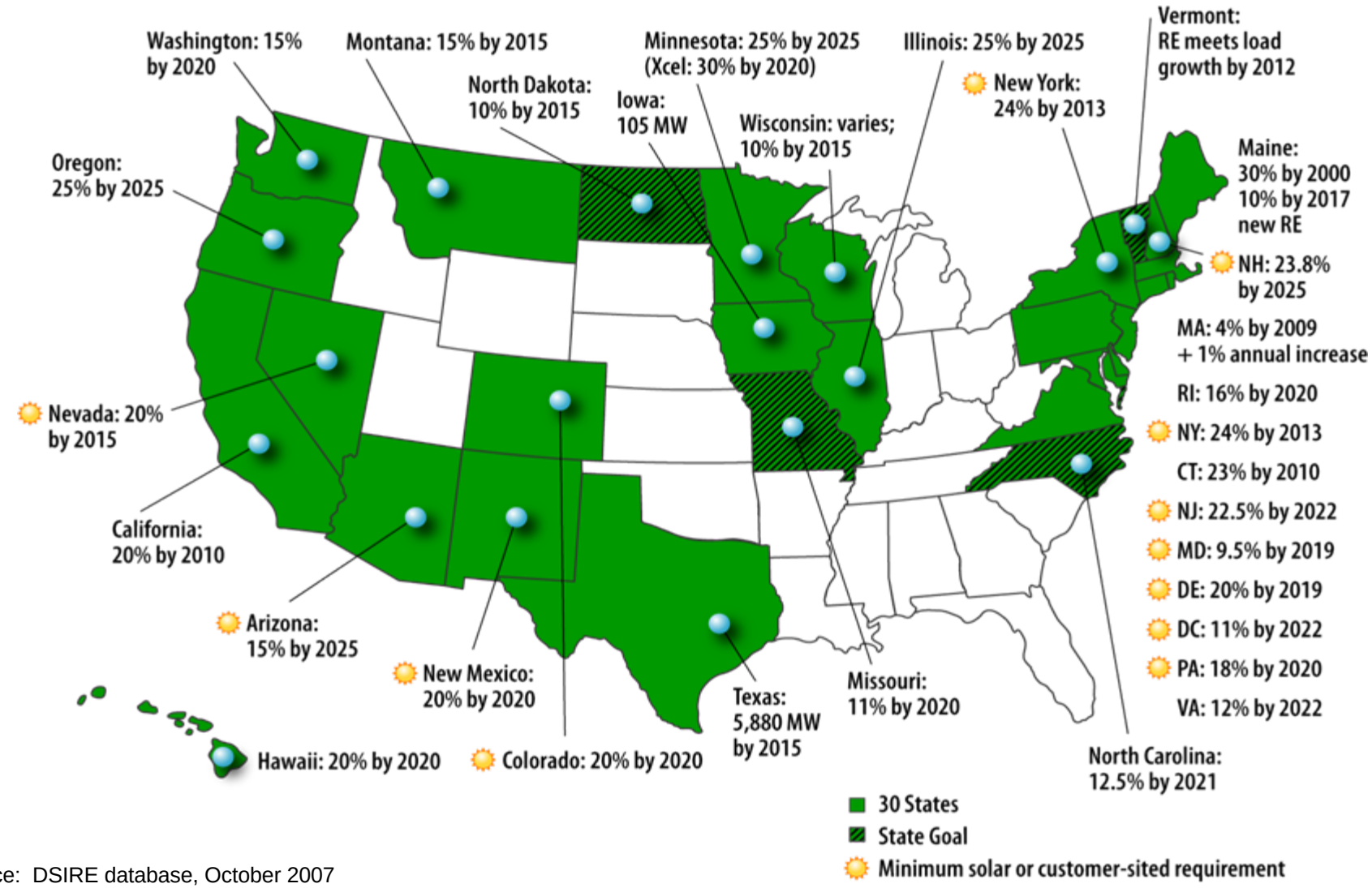
Updated February 2008
Sources: 1- National Biodiesel Board
2 - Renewable Fuels Association, all other information based on DOE and USDA sources

Accelerating Progress



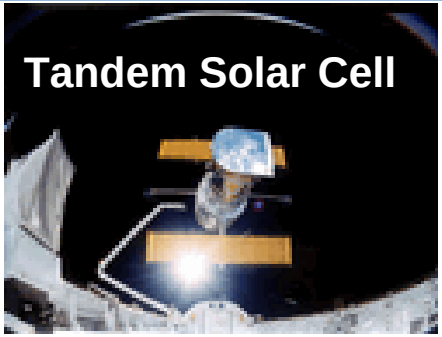
State Policy Framework

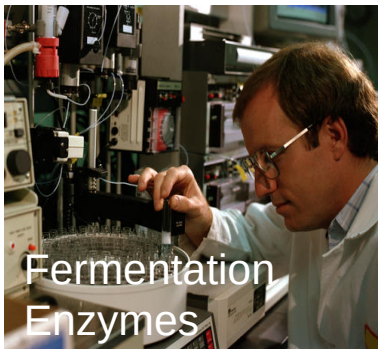
Renewable Portfolio Standards



Source: DSIRE database, October 2007

Technology Transfer





- Strategy focuses on fast transaction speed, transparency, being venture-capital friendly, enhancing the value of intellectual property (IP), and broad value proposition
- Intellectual property attracts partners that move technology toward commercialization
- Industry Growth Forum joins investors and entrepreneurs
- NREL has a portfolio of 278 patents, copyrights, and trademarks; and 47 active licenses

Growing the Industry

20th NREL Industry Growth Forum

Financing the Path to a Clean Energy Future

Denver, Colorado • November 6-8, 2007

Forum Feedback 

Apply to Present 

Sponsorship Opportunities 

Hotel & Registration 

19th Forum Proceedings 

Application to Present

Applicant Information

We will begin accepting applications in May 2007. Application fee (non-refundable): $250 (includes one registration - additional registrants at government rate)

Conference Fees

Professional Registraton
Early (by 10/1) - $850
Regular (by 10/13) - $950
On-site - $1,050

The National Renewable Energy Laboratory's (NREL) 20th Industry Growth Forum was held on Nov. 6-8, 2007, in Denver, Colorado. On the NREL Web site, you'll find presentations from this Forum.

NREL 20th Industry Growth Forum Agenda

NREL's Industry Growth Forum is the premiere clean energy investment forum not only because of the caliber of investors and entrepreneurial companies it attracts, but also due to its unique format and window on the energy future. Its rich "educational content" distinguishes NREL's Growth Forums and leaves all participants - including entrepreneurs, venture capitalists, and corporate investors - with a deeper understanding of the evolving energy market and what a business must do to thrive. Our format provides intensive feedback to competitively selected entrepreneurs from a panel of investors and industry

Founding Sponsors

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http://www.cleanenergyforum.com/

Clean Energy Resources for Entrepreneurs

NREL **Working with Entrepreneurs**

Clean Energy Business Incubators | Industry Growth Forums | Clean Energy Market Opportunity | **Resources for Entrepreneurs** | Get Involved | Contact Information | Upcoming Events

Resources and Information for Renewable Energy Entrepreneurs

Need help writing a business plan? Looking for sources of funding to finance start-up or growth? Want information about strengthening marketing efforts or targeting new customers? Countless informational and how-to resources—from Web sites and databases to books and periodicals—are available to renewable energy entrepreneurs, often at little or no charge. Below is a sampling of such resources. This list is provided by NREL as a service only and does not constitute an endorsement of any particular resource or organization. Please choose from the following categories:

- Resources for Starting and Growing Small Businesses
- Directory of Clean Energy Investors
- Business Incubators
- Market Development and Marketing
- Financing: Understanding the Ins and Outs
- Financing: Government Grants and Other Funded Programs
- Strategic Alliances

NREL GROWTH LINK

NREL Growth Link provides an on-going web-based platform for keeping the clean energy investment community up-to-date on your progress and partnering needs. Think of Growth Link as a tool to compliment your overall growth strategy. Becoming a Growth Link member offers numerous benefits. For more information, visit the Growth Link site or download this file. (MS Word 299 KB)

http://www.nrel.gov/technologytransfer/entrepreneurs/wwe_resources.html

NREL Has Strong Collaboration with Swedish Partners

- Hosted Swedish Prime Minister in 2007
  - Followed by visit of NREL Director to Sweden and then Swedish officials to NREL
- Launching Activities in Support of U.S./Sweden Renewable Energy Agreement:
  - Joint work on thermo-chemical and biological biofuel production
  - Exploring potential collaboration with Volvo-Mack on advanced battery design and testing heavy duty engines
  - Sharing policy best practices data – U.S. state policies and Swedish national policies
  - Opportunities for enhanced scientific exchange including encouraging Swedish post-docs to apply for positions at NREL
  - NREL is an active participant in the U.S.-Sweden renewable energy working group
- Continuing joint work through IEA implementing agreements and researcher driven collaboration on PV technologies with Dalarna, Chalmers, and Uppsala Universities

An Integrated Approach is Required

Promise of renewable energy is profound and can be realized if we…

- Aggressively seek a global sustainable energy economy
- Accelerate investment in technology innovation
- Work with our international partners to learn from each other

It is a matter of national will and leadership


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