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Electric Power Industry Trends and the Role of Renewable Energy

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DEPENDABLE ENGINES

Product Portfolio

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Large Engines

Power Systems

ORC
Heat to Power

After market

Mobile Power

Marine

Wind Power

Global footprint

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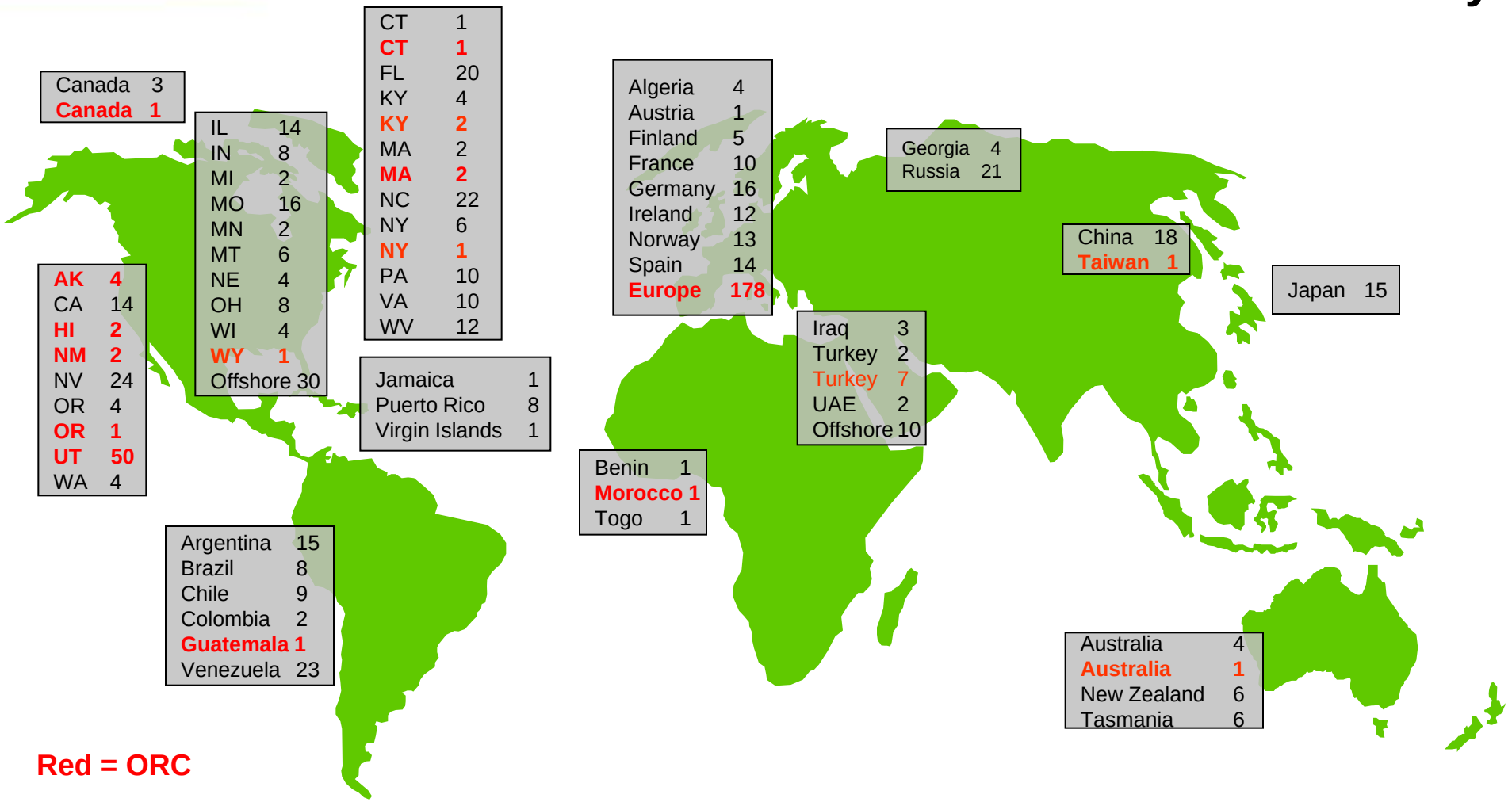
Gas Turbine & ORC Fleet Summary



Red = ORC

Over 2000 Gas Turbines and 250 ORC's Sold World Wide

ENERGY SUPPLY

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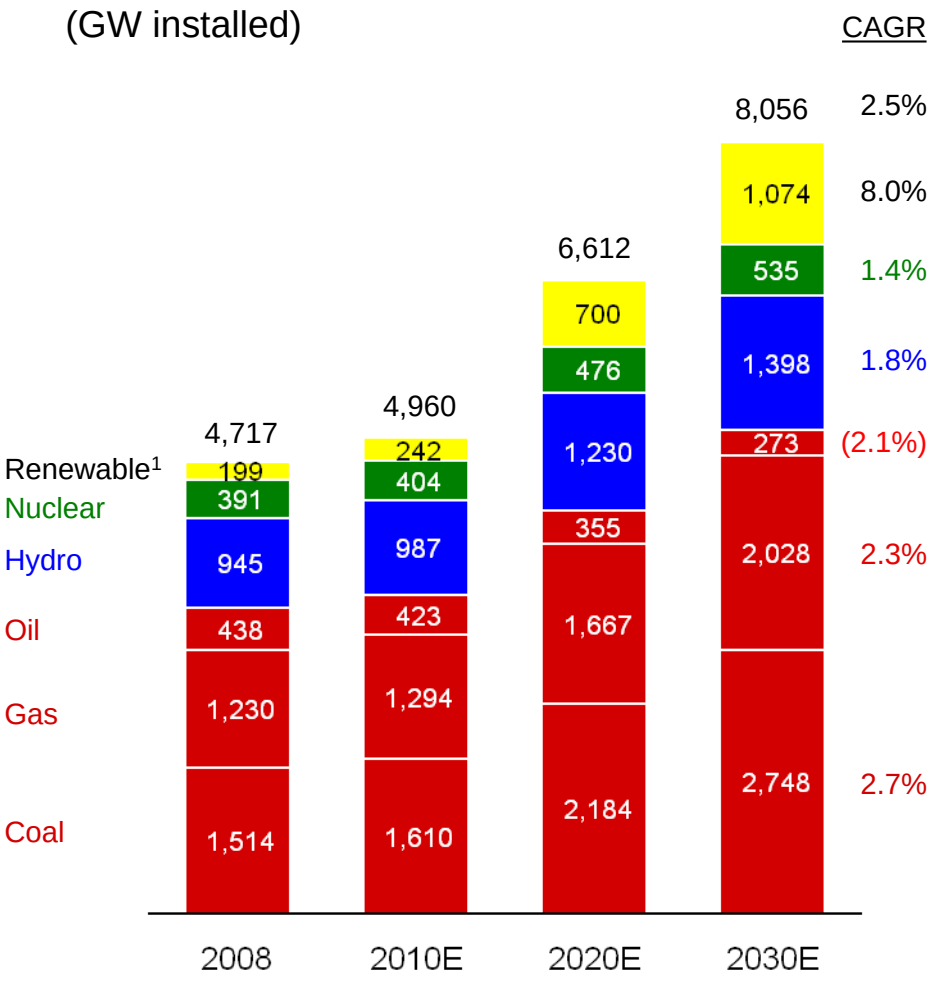
Global energy mix

(by fuel source)



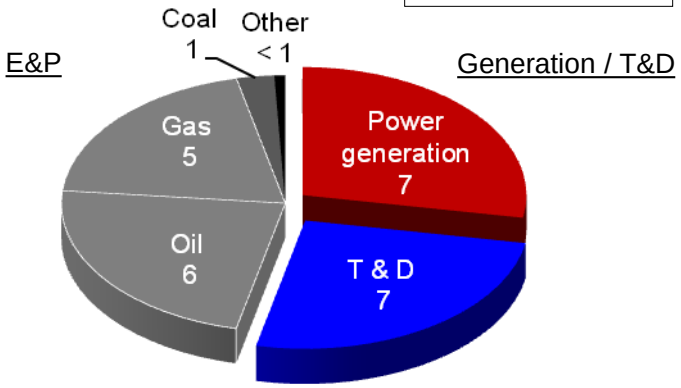
Energy investments

(2008 – 2030E)

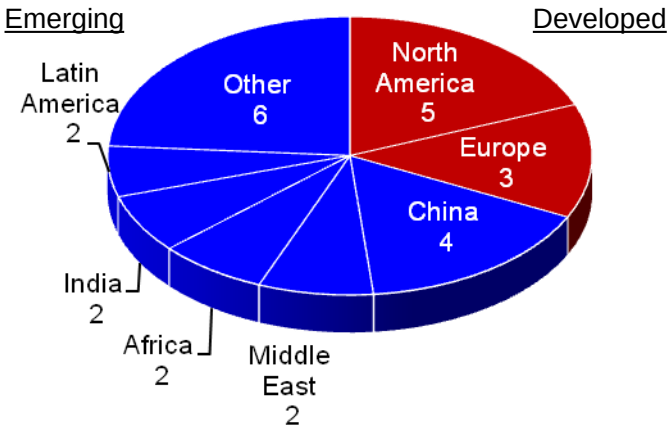
($ trillions)

100% = $26T

By type



By region



[1]Includes Wind, Solar, Biomass, Geothermal

Source: International Energy Agency – World Energy Outlook 2009, 2010

US Electricity Generation Mix

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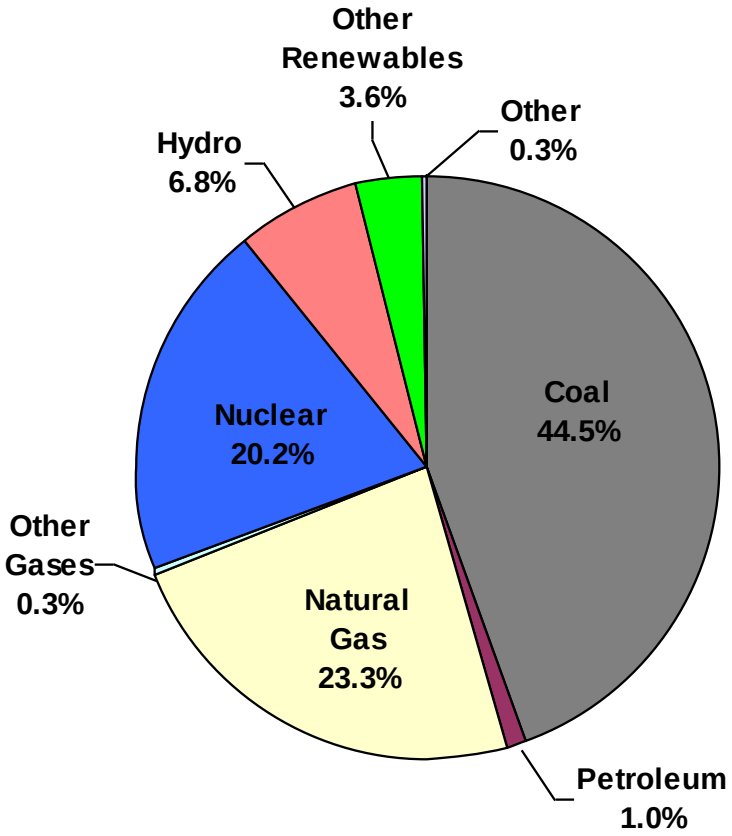

* Energy Information Administration report, Nov. 2010

Trends

- ↓ Coal: Prices increased 84% from 2000-2009. Coal fired generation declined 11.6% in 2009 (lowest level since 1978)
- ↑ Natural Gas: Wellhead prices fell to lowest level in 7 years. NG based generation increased by 4.3% in 2009 to the highest level since 1970
- ↓ Nuclear: Decreased by about 0.9% in 2009 (outages and derates)
- ↓ Petroleum: Peaked in 1973 (17%), steadily decreasing since, 15.8% decrease in 2009 compared to 2008
- ↑ Hydro: Increased 7.3% in 2009 compared to 2008
- ↑ Renewables: Increased 14% increase in 2009 following a 20% increase in 2008. Wind power increased the fastest (34% increase), solar 3%.

ROW Electricity Generation Mix

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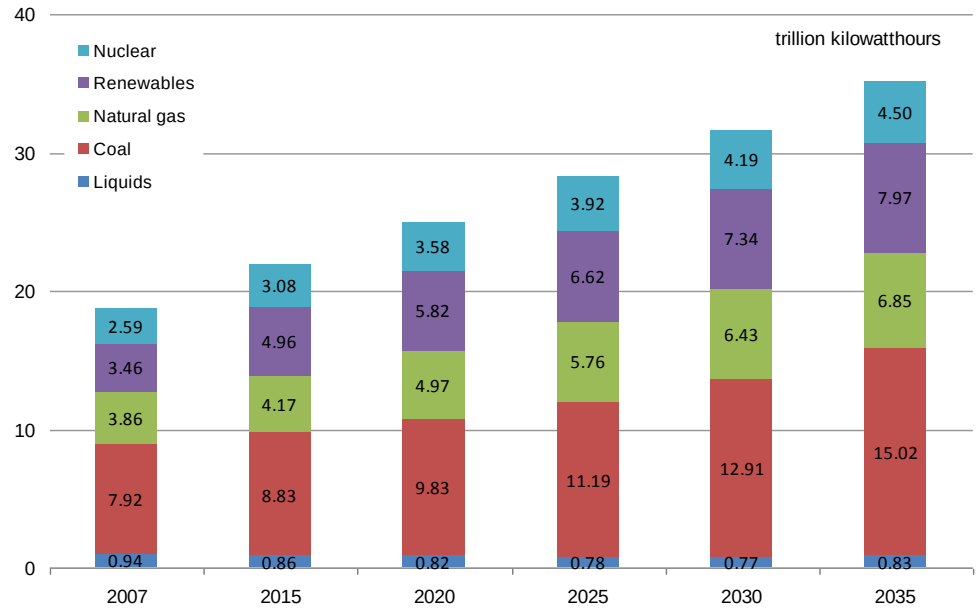

* Derived from EIA, International Energy Statistics database (as of November 2009), web site www.eia.gov/emeu/international. Projections: EIA, World Energy Projection System Plus (2010).

Trends

- ⬆ Coal: Remains steady at 42% (2007-2035), annual increase of 2.3%
- ⬆ Renewables: Highest rate of annual increase, 3% until 2035. Share of renewable generation is projected to increase from 18% (2007) to 23% (2035)
- ⬆ Natural Gas: Increases at the annual rate of 2.1%
- ⬆ Nuclear: Increases at the annual rate of 2% but considerable public concerns may hinder plans for new installations

THE ELECTRIC POWER INDUSTRY AND ROLE OF GEOTHERMAL

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- **Renewable energy accounted for approximately 11% of the domestically produced electricity in the US in the first six months of 2010.**
- **Renewable Energy Capacity in the world and US has more than tripled between 2000 and 2009.**
- **Over the last three decades, US geothermal power-generation industry has grown to be the largest geothermal market in the world with over 3,100 MW of installed electrical capacity.**

(Sources: Electric Power Monthly June 2010, DOE/ NREL 2010, GEA report)

Global Demand for Wind Power

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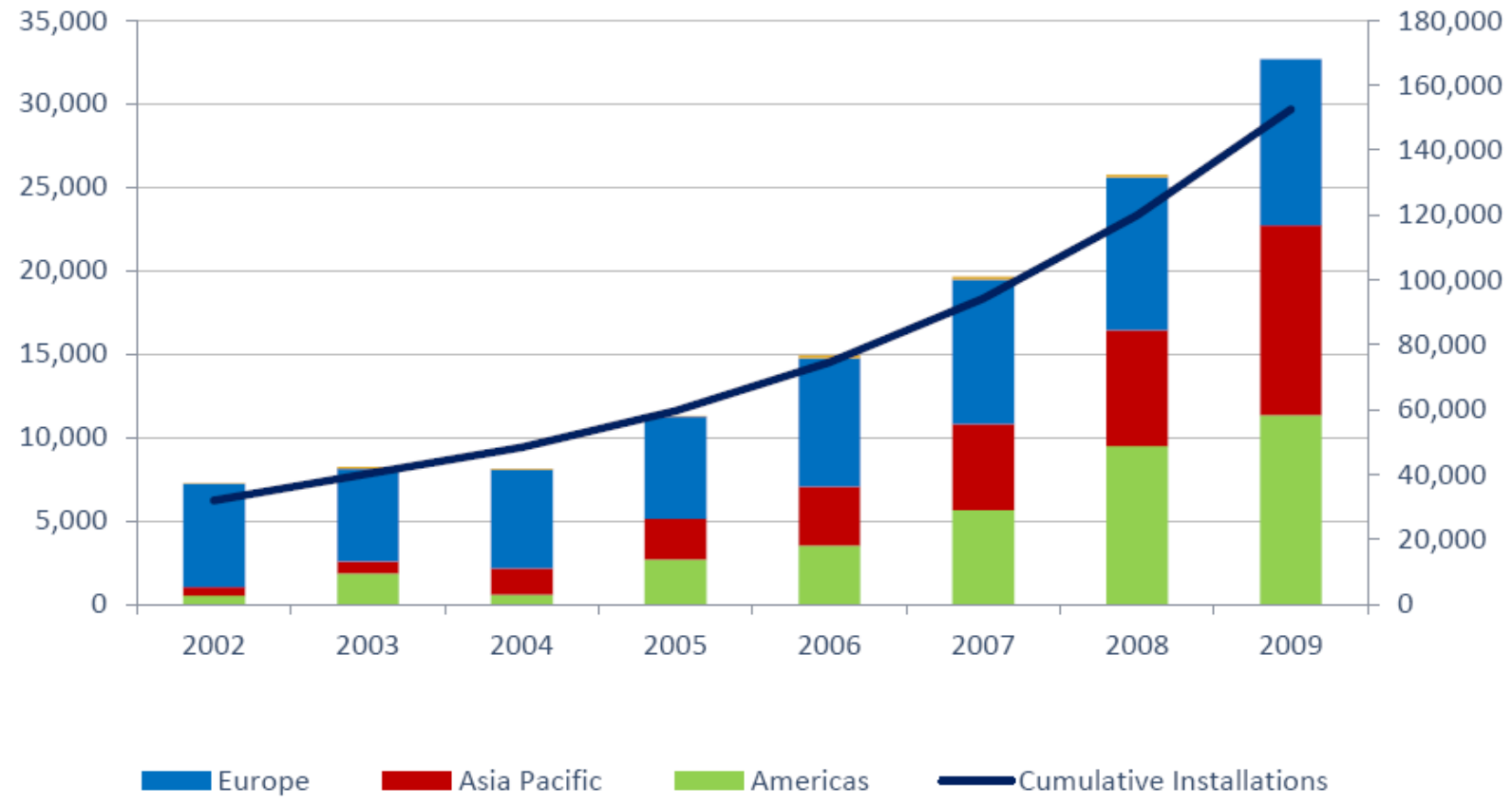
Figure 8. Global Wind Power Growth, Annual vs. Cumulative (MW)



Source: MAKE Consulting

Global Perspective – Wind Future

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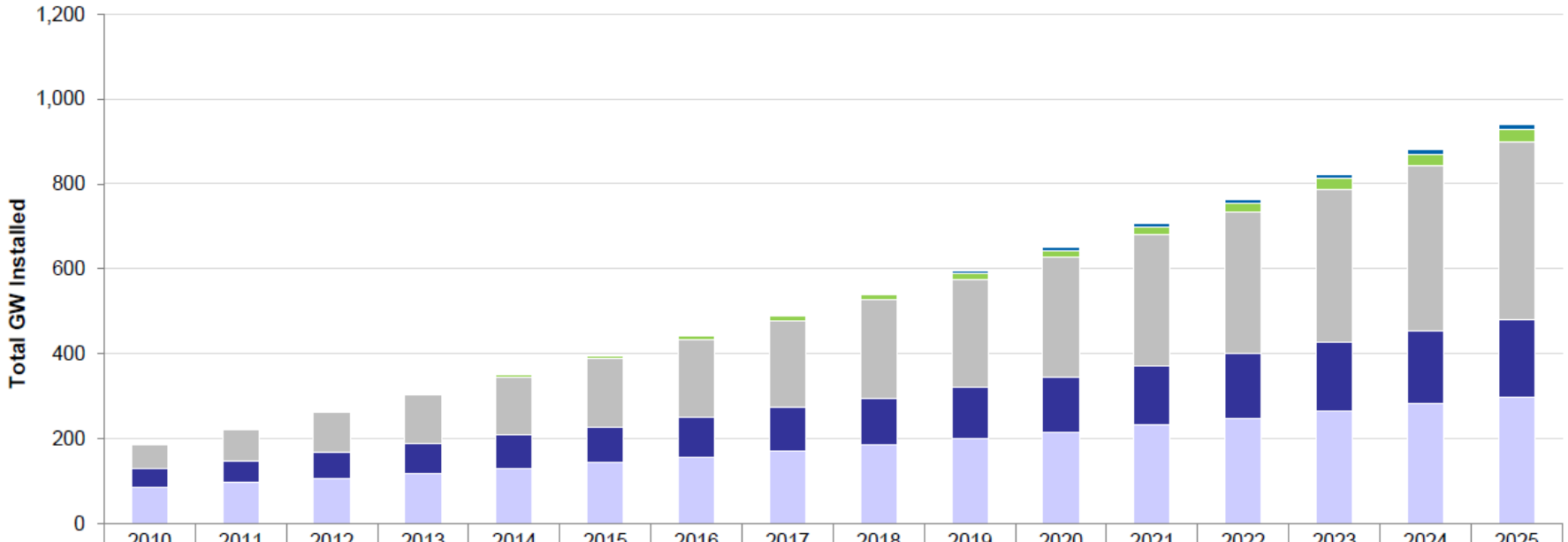
IHS / EER Base Case Global Wind Market Projections



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Total	188.1	225.8	267.2	310.0	353.3	398.4	445.8	493.7	543.8	595.4	650.3	706.5	763.6	821.9	881.3	941.0
Africa Middle East	1.2	1.3	1.7	2.2	2.7	3.2	3.8	4.5	5.2	6.0	6.9	7.8	8.9	10.2	11.5	13.0
Latin America	1.4	2.5	3.8	5.1	6.3	7.5	9.0	10.4	12.2	14.2	16.4	18.9	21.5	24.3	27.2	30.2
Asia Pacific	54.7	73.3	93.7	114.9	136.7	159.1	182.1	205.8	230.2	255.3	281.2	307.3	333.9	360.9	388.3	416.1
North America	44.7	52.5	60.3	68.4	76.5	84.5	93.5	101.8	110.3	118.8	129.2	140.4	151.1	161.7	172.3	182.8
Europe	86.0	96.2	107.7	119.5	131.3	144.1	157.5	171.2	186.0	201.2	216.7	232.1	248.1	264.8	282.0	298.8

Global Geothermal Market

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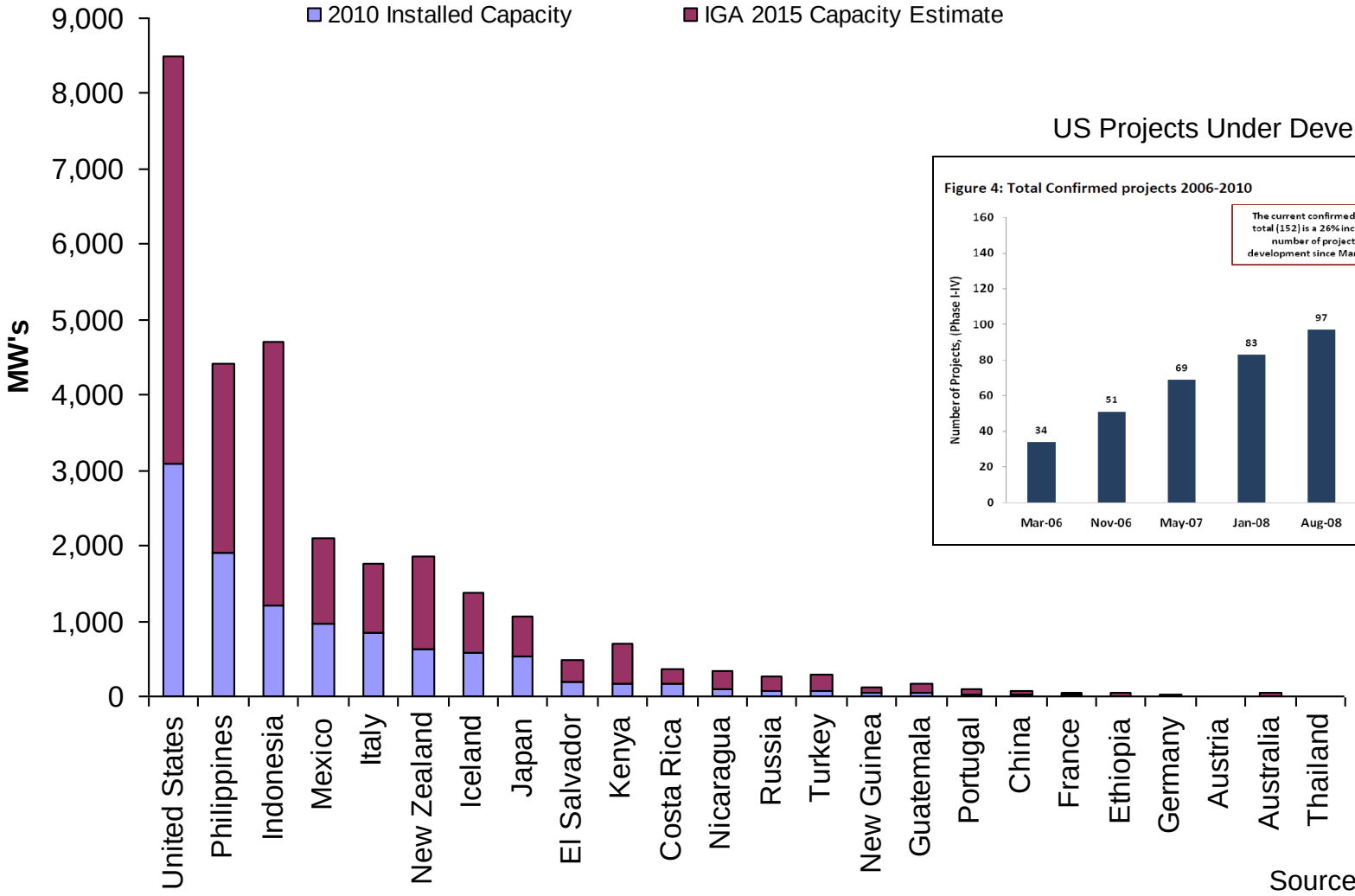
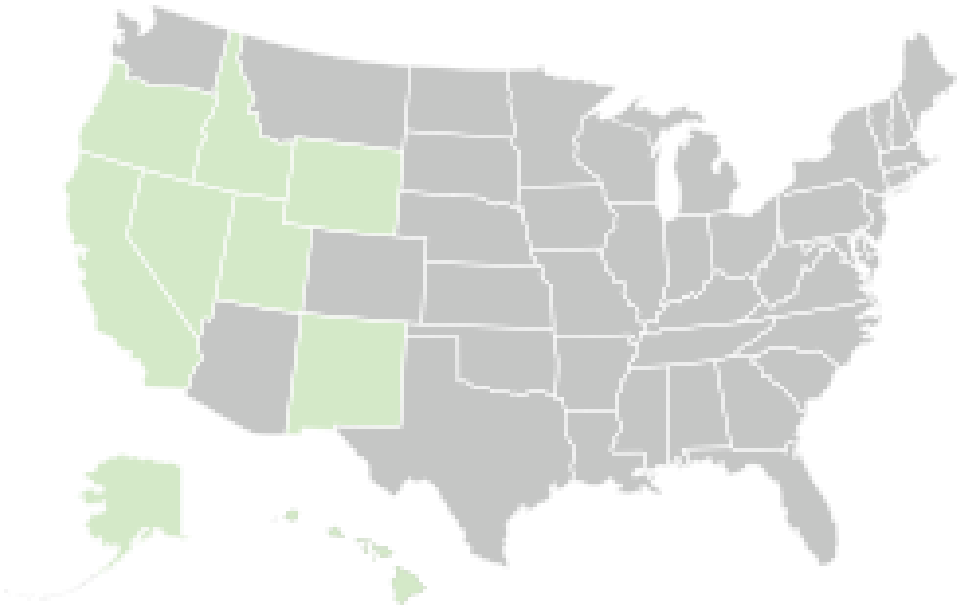
- Estimated 40% (~3000MW's) new capacity is ORC



US Projects Under Development

Source: GEA May 2010



Nine States generate the majority of this power in the U.S.:

Alaska, California,

Hawaii, Idaho, Nevada, New Mexico,

Oregon, Utah, Wyoming.

(Source: GEA)

Snapshot of US Renewable Energy Portfolio

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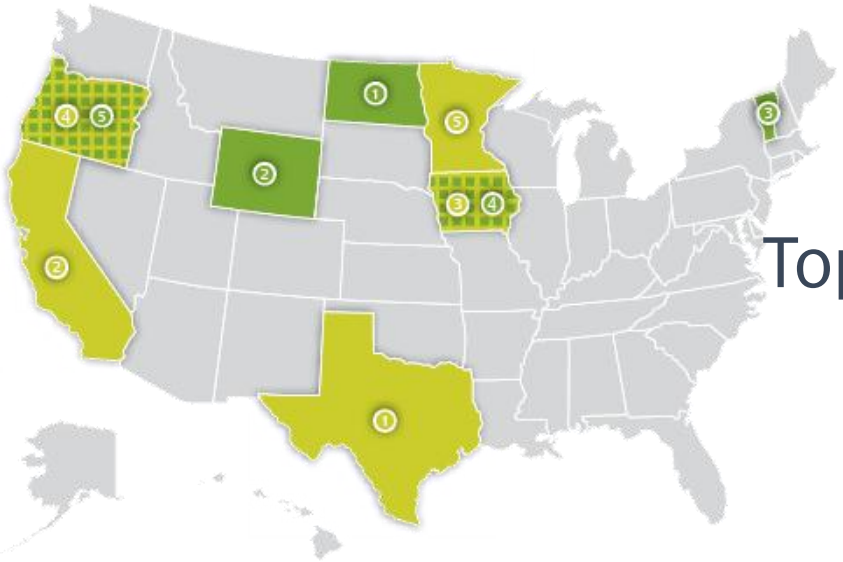

Top States for Renewable Installed Nameplate Capacity – 2009 (Excluding Hydropower)

Total Renewables (excluding hydropower)
1 Texas
2 California
3 Iowa
4 Oregon
5 Minnesota

Per Capita Renewables (excluding hydropower)
1 North Dakota
2 Wyoming
3 Vermont
4 Iowa
5 Oregon

(Source: US DOE/ NREL 2010 Study)

Snapshot of US Renewable Energy Portfolio

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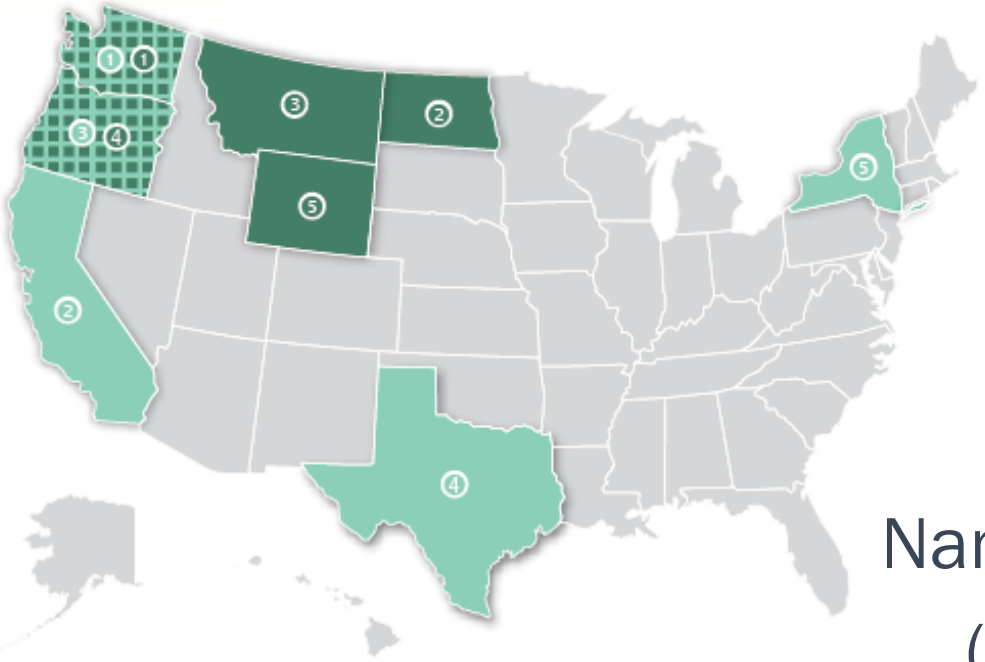

Top States for Renewable Installed Nameplate Capacity – 2009 (Including Hydropower)

Total Renewables (including hydropower)
1 Washington
2 California
3 Oregon
4 Texas
5 New York

Per Capita Renewables (including hydropower)
1 Washington
2 North Dakota
3 Montana
4 Oregon
5 Wyoming

(Source: US DOE/ NREL 2010 Study)

US Renewable Energy Profile

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- **In the US, wind and Solar Photovaltaics (PV) are seeing large growth.**
- **Wind capacity increased by nearly 40% in 2009.**
- **PV capacity grew nearly 52% from 2008 to 2009.**
- **Competitive pricing pressures are prevalent in both Wind and Solar PV markets (China influence)**
- **Worldwide, wind is the fastest growing renewable energy technology.**
- **Renewables are capturing a growing percentage of new capacity additions accounting for more than 55% of new electrical capacity installations in the US, up from 2% in 2004. *Will this trend continue???***

Top Countries with Installed Renewable Electricity

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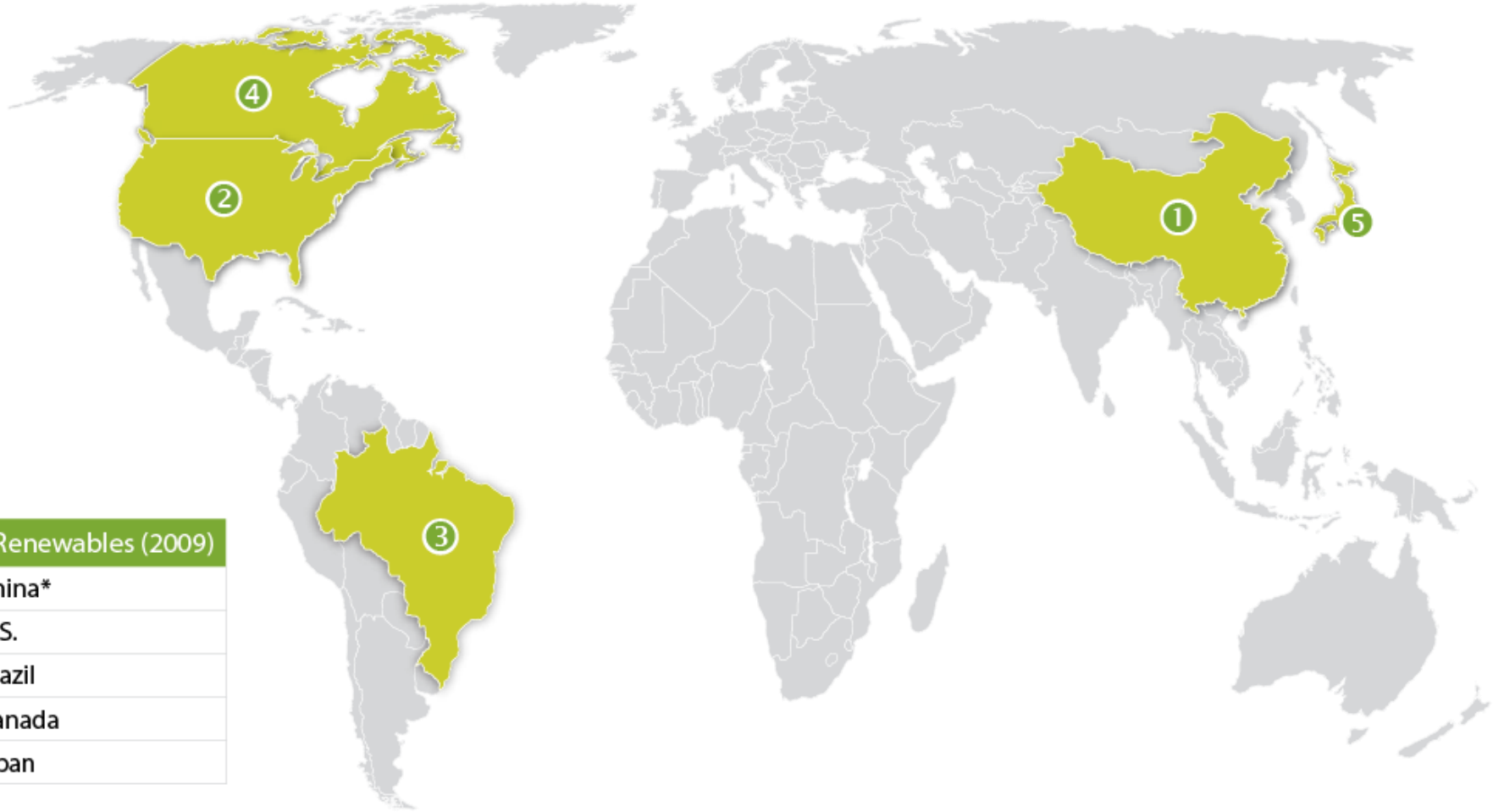

Total Renewables (2009)
1 China*
2 U.S.
3 Brazil
4 Canada
5 Japan

•Majority of China's renewable energy is from small hydropower.
Source: DOE/NREL 2010)

Top Countries with Installed Renewable Electricity by Technology

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Geothermal	Wind	Solar PV	CSP	Biomass
US	US	Germany	US	US
Philippines	China	Spain	Spain	Brazil
Indonesia	Germany	Japan		Germany
Mexico	Spain	US		China
Italy	India	Italy		Sweden

Source: DOE/NREL 2010

Federal Subsidies & Tax Relief/Incentives

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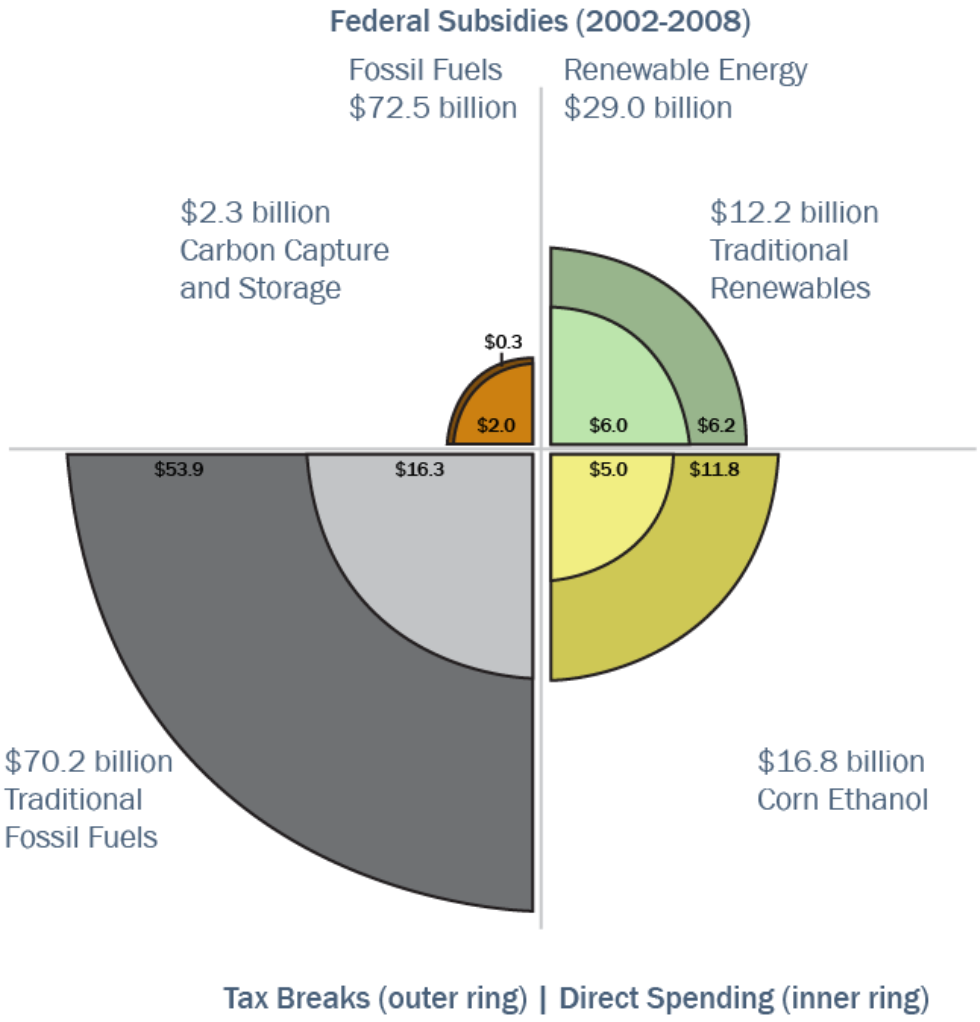

Incentives need to be longer than 1-2 years.

The investment community needs clear picture of future incentives.

Longer term incentives needed to support longer term investments.

Federal Subsidies & Tax Relief/Incentives

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- **Brief History of incentives**
  - **Energy "subsidies" come in a variety of forms.**
  - **Subsidies go to all forms of energy, including fossil fuels and alternatives.**
  - **Oil and gas accounted for 60% of an estimated $725 billion in federal assistance between 1950 and 2003.**
  - **Wind, solar, geothermal and biofuels combined to account for only 6%.**

Federal Subsidies & Tax Relief/Incentives

President Obama said in a speech to the United Nations following the G20 Summit in 2009:

"I am proud to say we will phase out fossil fuel subsidies so that we can better address our climate challenge."

Federal Subsidies & Tax Relief/Incentives

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The American Recovery Reinvestment Act of 2009 (ARRA) provided $1.64 billion for renewable projects, but many of those incentives have closed or close this year.

(Source: DOE)

Geothermal Growth

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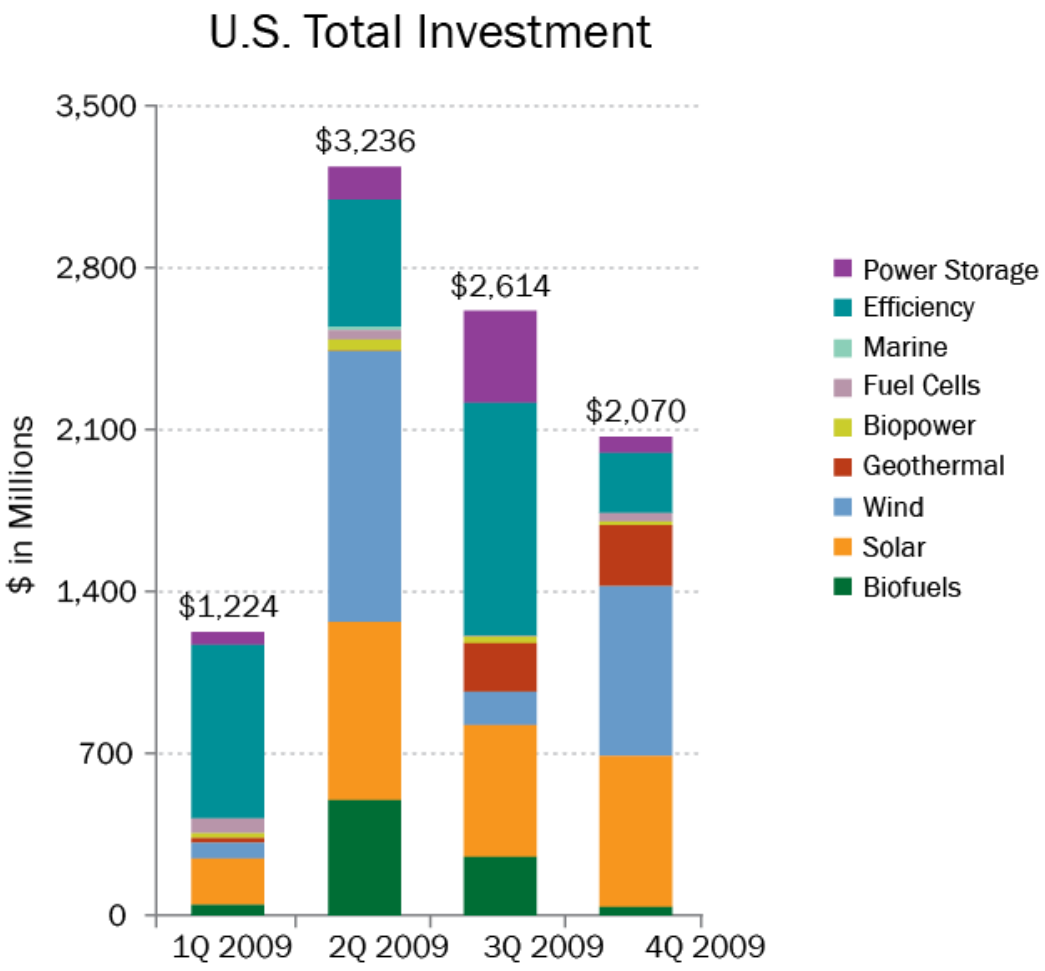

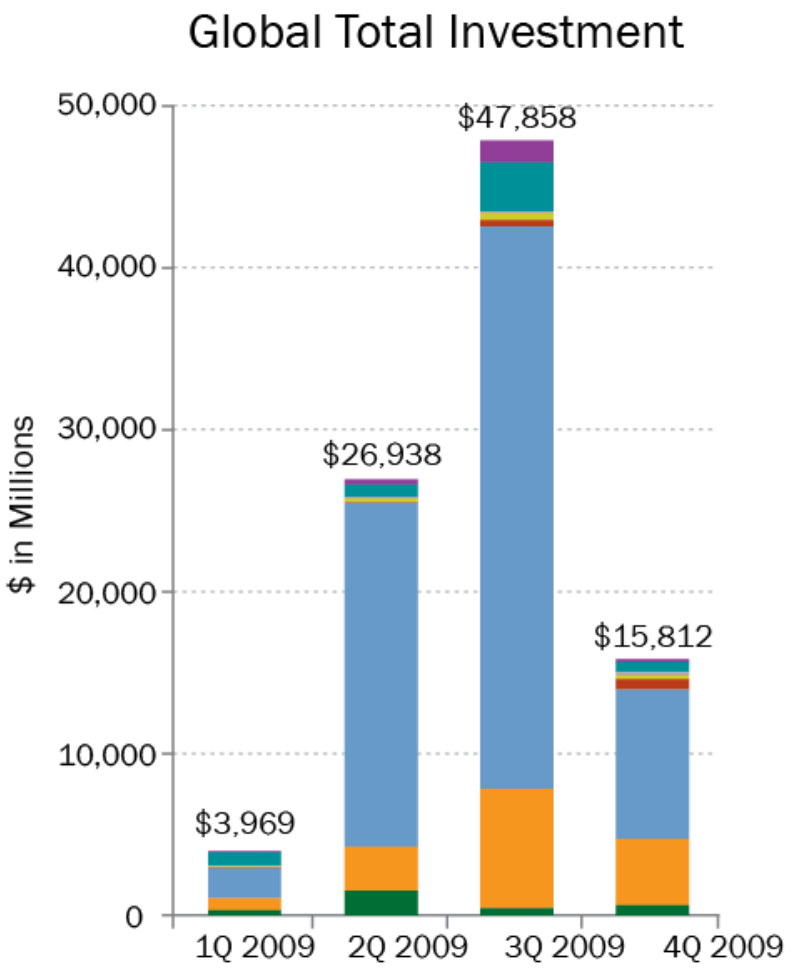

(Source: Bloomberg New Energy/Finance)

Geothermal Growth

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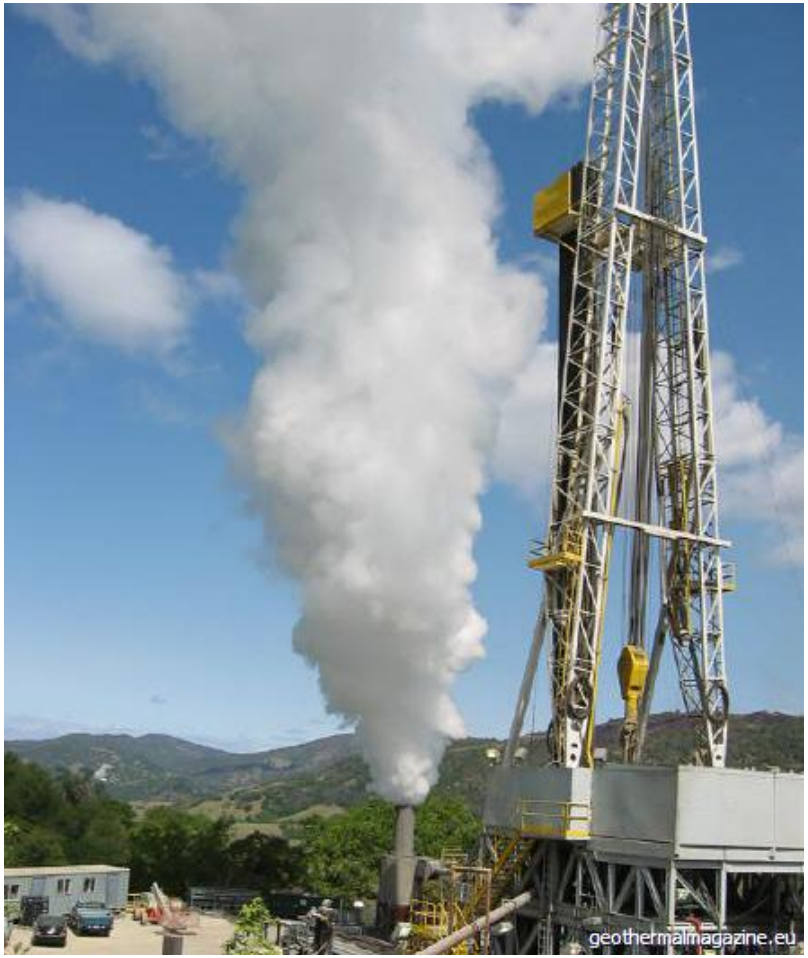

U.S. total investment in geothermal grew throughout the year 2009.

Worldwide total investment also grew slightly in 2009.

U.S. Venture Capital and Private Equity investments in geothermal technology companies have been minimal compared to other renewable, such as solar and wind.

Nuclear Shortfall – Now What?

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The New York Times

Germany's Phaseout Puts a Spotlight on the Cost of Its Renewables Strategy

June 10, 2011

"Germany's decision to phase out nuclear energy by 2022 will transform Europe's largest economy into a multibillion-dollar laboratory experiment on the rapid deployment of renewable energy and smart grid technologies…"

OR

"…if these initiatives fall short, it could leave consumers exposed to higher power prices and make German industry less competitive and the nation more dependent on fossil fuel sources and imports from France's nuclear plants."

Renewable Energy Market Challenges

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- **Assistance for renewables has been debated in Congress and is often the subject of controversy, leveraging alternative tactics, and inconsistent policy.**

This leads to market uncertainty, compromising investment opportunities, and technology development inefficiencies.

- **Renewable energy generation remote locations require electric power transmission grid infrastructure investments.**
- **Cyclic operating characteristics (non-geothermal) create electric power grid stability challenges.**
- **Ability for geothermal applications to attract investment/interest from the oil and gas sector, thus leveraging existing and characterized resources (co-produced fluids).**

Questions?

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