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INSIGHTS

Germany's Revolution in Efficiency and Renewable Energy

Amory B. Lovins

© Rocky Mountain Institute

The March 2011 Fukushima accident destroyed four and shuttered most (currently all) of Japan's 54 nuclear plants. Japan replaced nuclear energy with discomfort, sacrifice, and costly fossil fuels, because utility oligopolies suppressed renewable competitors and national energy efficiency languished. Two and a half years later, power reserves, though easing, remain tight, fuel bills exorbitant, and carbon emissions elevated.

In contrast, Germany, the world's fourth-largest economy, launched a purposeful, careful, and successful energy transition in 1991, and agreed in 2000 to shut down nuclear power over a couple of decades. The pace quickened in 2011, when all political parties agreed to shut down the oldest 41% of Germany's nuclear capacity immediately, the rest by 2022. But unlike Japan, Germany offset its entire 2011 nuclear loss in the same year—three-fifths by added renewable power—remaining a net exporter of competitive electricity.

In 2011, Germany's economy grew 3% and stayed Europe's strongest, boosted by 382,000 renewable energy jobs, many for exporters. Power reliability remained the best in Europe—about ten times better than America's. Efficiency gains (plus a mild winter) cut Germany's 2011 energy use 5.3%, electricity consumption 1.4%, carbon emissions 2.8%, and wholesale electricity prices 10–15%.

Repeating 2011's renewable additions for a few more years would



displace Germany's entire pre-Fukushima nuclear output. With one-ninth Japan's high-quality renewable resources per hectare, Germany achieved nine times Japan's renewable share of power generation—How?—By giving renewables fair grid access, promoting competition, weakening monopolies, and encouraging citizen and local ownership (now two-thirds of renewable capacity, which rivals peak demand). Germany's pump-priming investments triggered global scaling-up that Deutsche Bank predicts in 18 more months will let solar power compete without subsidy in three-fourths of global markets. With 30 billion watts of solar rooftops, German installed prices last year were half those of America.

In 2012, Germany's nuclear generation reached a 20-year low while net power exports hit a new high. (Only Germany consistently

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Editor's Notes

The current issue of Global Energy Affairs features two unique perspectives on nuclear energy. Amory Lovins highlights how Germany, unlike Japan, utilized its decision to abandon nuclear energy to create a revolution in efficiency and renewable energy. Malcolm Grimston contends that despite a highly favorable environment for nuclear development in the UK, the market response remains weak. Sheril Kirshenbaum highlights how the public opinion in the U.S. contributes to defining global energy priorities. Audi's e-gas car and tracking progress of Masdar City are the projects of this month. News highlights, innovations, and briefs cover recent major developments in the field of energy and environment. Roel Sweirenga's reflections on the on Sustainable Mobility for the Decade 2014-2024 and the profile of Quayle Hodek, a young leader in renewable energy, completes this issue

US TO SURPASS RUSSIA AS LARGEST OIL AND NATURAL GAS PRODUCER

The US will surpass Russia as the largest producer of oil and gas by the end of the year. Oil and gas output for the US reached 22 million b/d in July, compared to Russia's 21.8 million b/d. Recent developments in shale gas production have transformed the US energy landscape, resulting in a 32% decrease in natural gas imports over the past five years. Last year, the US exceeded Russian natural gas production for the first time since 1982. Technological advancements, particularly in directional drilling have also allowed the US to increase domestic oil production. Crude oil production in July averaged 7.5 million b/d—the highest level in 20 years. Long-term forecasts for US energy dominance remain uncertain and will depend on the volatility in gas prices, which are expected to range between US\$4.00-\$6.50/MMBtu. Russia also has large, untapped gas reserves in the Arctic region, which it could exploit in the future.



INDIA ANNOUNCES PLANS TO BUILD WORLD'S LARGEST SOLAR POWER PLANT

India's government has finalized plans to build a 4,000MW solar plant near Sambhar Lake in Rajasthan. The project is a joint venture between five government-owned companies of India—BHEL, Powergrid Corporation, Solar Energy Corporation of India, Hindustan Salts and Rajasthan Electronics and Instruments Limited. Completion of the 23,000 acre solar plant will triple India's total current solar power capacity of 1,600MW. The first phase of the project is expected to be complete in 2016 and will generate 1GW of solar energy. India is seeking large-scale renewable energy projects as part of long term energy plan to increase energy independence and cost competitiveness with fossil fuel alternatives. The country imports more than 80% of its oil and is predicted to import more than half of its total energy needs by 2030. Given the performance record of Indian government companies, it would be a great challenge to meet these ambitious targets.

COAL TO OVERTAKE NATURAL GAS IN SOUTHEAST ASIA

Southeast Asia is projected to triple its coal demand between 2011 and 2035, overtaking gas as the dominant fuel source in the region. Demand for coal has been growing rapidly at double-digit rates since 1990, according to the EIA. This has largely been driven by economic growth among the 10 ASEAN members, in addition to the abundance and affordability of coal compared to alternative fuel options. Assuming that coal is priced at US\$80 per ton, it will be 30% cheaper than natural gas, EIA predicts. Indonesia, the region's largest coal exporter will increase production by 90% to 550 million tons in 2035. With Southeast Asia becoming increasingly reliant on coal, the region must take initiatives to address the environmental repercussions of carbon pollution. Carbon dioxide emissions are set to double during the period, reaching 2.3Gt in 2035. To curtail the growth of carbon emissions, the ASEAN members should take steps to improve energy efficiency in the industrial sector and fuel-economy standards.



RUSSIA AWARDS FIRST-EVER SUBSIDIES FOR RENEWABLE ENERGY

Russia has signaled its support for fossil fuel alternatives by awarding subsidies to 39 clean energy companies. The projects will generate a combined 504MW of renewable energy, 79% of which will be derived from solar power. Earlier in May, President Vladimir Putin ratified a subsidy program that will add 6GW of renewable energy capacity by 2020. Under the agreement, firms must produce at least 5MW of output and are eligible to receive payments for up to 15 years. The second tender is scheduled for June 2014, and will auction off 2,141MW of wind and solar power. Russia has aimed to increase its share of renewable energy to 2.5% by 2020, from 0.8% at present. However, the country faces several challenges to achieving its goal given the abundance of fossil fuels across the region and a lack of willingness from households to pay for more costly alternatives.

ANGOLA PLANS TO INCREASE POWER OUTPUT FIVE-FOLD BY 2025 TO ATTRACT FDI

Angola is aiming to quintuple generation capacity by 2025 as part of a broader strategy to attract foreign investment in the country. The Ministry of Energy and Water has announced plans to build 15 hydroelectric plants that will increase generation capacity from 1,800MW at present to 9,000MW. It will seek assistance from companies including Brazil's Odebrecht SA and Xinjiang TBEA Group Co. of China. Hydropower is the dominant energy source in Angola, providing two-thirds of the country's energy supply. The government has made a target to reach US\$4 billion in non-oil foreign investments annually by 2017. It also aims to double electricity access amongst its population to 60% by 2025. Efforts to develop the country's power infrastructure have been plagued by 27 years of civil conflict. Last year's presidential election caused further complications to the nation's advancement, dragging the energy sector into the public discourse.



CARBON EMISSIONS IN JAPAN ROSE FURTHER IN 2012

Japan emitted 1.207 billion metric tons of carbon dioxide equivalent in the fiscal year ending March 2013, narrowly missing the 1,218 billion metric tons recorded during the 2007-08 fiscal year. Emissions increased 2.8% from the previous year and are predicted to increase a further 0.7% in the upcoming fiscal year. Since the 2011 Fukushima incident, Japan has been forced to compensate for the 94% decrease in nuclear power production by seeking alternative energy sources. Last month, the government shut down the only working nuclear reactor for a routine check-up, leaving the country nuclear-free for the second time since March 2011. The nuclear shortage has resulted in higher demand for natural gas and petroleum, which increased by 20% and 4.7%, respectively during the fiscal year. With several reactors predicted to restart in mid-2014, it is unlikely that the upward trend in carbon emissions will persist. The Institute of Energy Economics Japan forecasts a 2.8% decline in emissions for the 2014 fiscal year, assuming that 16 nuclear reactors are operating.

CONSTRUCTION BEGINS AT THE FIRST NUCLEAR POWER PLANTS IN BANGLADESH

Prime Minister Sheikh Hasina has laid the foundation stone for the first nuclear power plant in Bangladesh, six years after the International Atomic Energy Agency signaled its approval. The 1,000MW Rooppur plant is located 135 miles west of Dhaka and will generate 10% of Bangladesh's total power. It is expected to be complete in five years at a cost of US\$2 billion. A second plant has been planned in Dhaka and will produce 2,000MW of additional capacity. Bangladesh has a daily power shortage of 2,000MW and suffers from frequent blackouts. Under the System Master Plan 2010, the government has aimed to reach 39,000MW of generation capacity by 2030, compared to the current 9,713MW. Bangladesh relies predominantly on its natural gas reserves, which satisfies more than 80% of the country's energy needs. However, existing gas reserves may run out within a decade, driving the push for cost-effective energy solutions.

SYRIA OIL OUTPUT EXPECTED TO DECLINE 60% IN 2013

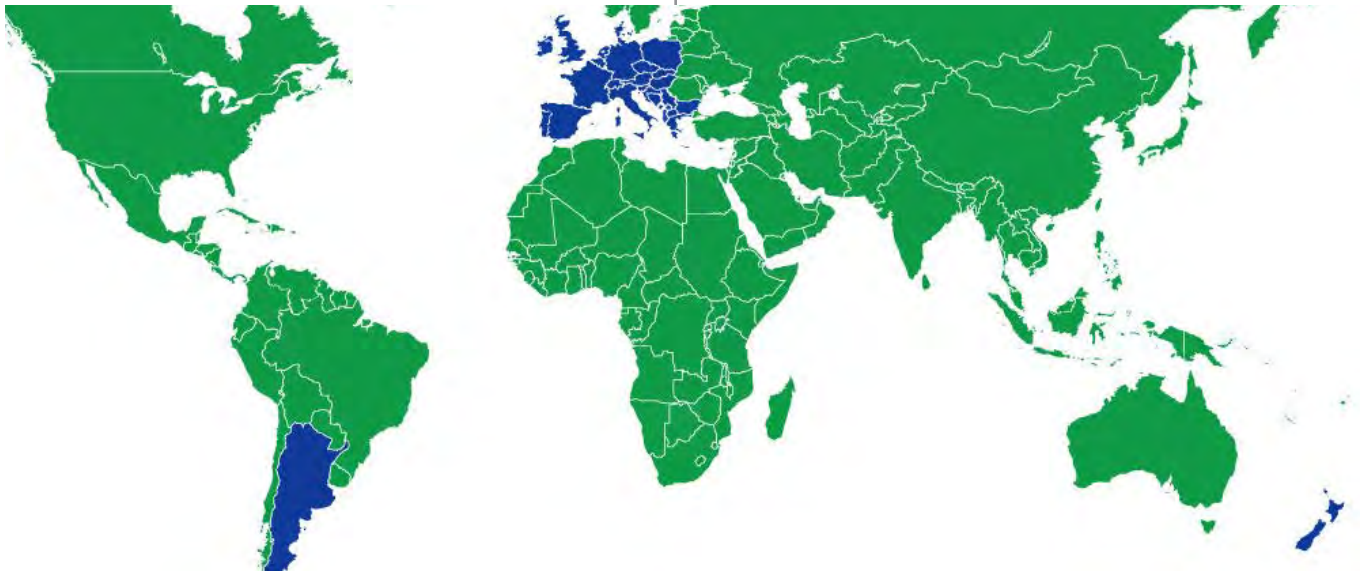
Oil production in Syria is anticipated to fall by 120,000 b/d to average 90,000 b/d in 2013, according to the latest OPEC report. Supply is likely to decrease further in the following year to 40,000 b/d as political tension and civil conflict remains high in the region. The government estimates that it has incurred almost US\$3 billion in losses from the oil sector, with crude oil production down 95% from the 380,000 b/d level produced prior to March 2011 when the conflict began. Despite the fact that Syria accounts for less than 0.1% of total world oil production, the situation threatens to spread across the Middle East and affect nations with larger oil markets. The additional threats of unrest in Libya and Egypt could also destabilize global markets and cause a sharp increase in oil prices. Last month, oil futures reached their highest level in 28 weeks as the political situation in Syria intensified.

BULGARIAN ELECTRICITY EXPORTS INCREASE 16-FOLD FROM JUNE LEVELS

Electricity exports from Bulgaria to neighboring countries increased 16 times in late September, compared to data from June 2013. During the peak hours of 6pm to 7pm, the country exported a total of 1,620 MWh—a third of which was received by Macedonia. Electricity flow to Serbia and Turkey was 441MWh and 452MWh, respectively. The recent spike in Bulgarian electricity exports is due in part to recent reductions in the electricity export tax. Bulgaria also increased the maximum transmission capacity for exports to Turkey from 400MW to 550MW. The country has the lowest electricity prices in the EU, averaging US\$0.07 per kWh. Bulgaria's government implemented a second round of price cuts in July, lowering the price ceiling that customers can be charged by 5%. The competitive pricing of Bulgaria's electricity has also made it a target for illegal electricity exports to neighboring territories, costing taxpayers more than US\$690 million over the past five years.

OIL AND GAS INVESTMENT IN ARGENTINA'S NEUQUÉN PROVINCE TO TOP US\$3.5 BILLION THIS YEAR

Shale oil and natural gas investment in the Neuquén province is expected to exceed US\$3.5 billion in 2013 as Argentina aims to improve its energy self-sufficiency. State-owned oil company YPF plans to spend US\$15 billion over the next decade to exploit resources in Loma la Lata and Vaca Muerta. The 5,000 acre Vaca Muerta ranks among the highest tight oil reserve areas in the world and was discovered by YPF in 2010. Argentina holds an estimated 27 billion barrels of shale gas, the fourth-highest in the world. The country became a net energy importer in 2011, coinciding with the re-nationalization of YPF. Still, energy imports account for a significant portion of Argentina's trade balance and are estimated to cost Argentina US\$13 billion this year. Last month the trade surplus decreased 59% to US\$578 million, much lower than the US\$983 million surplus predicted.



NEW ZEALAND INAUGURATES LANDMARK BINARY GEOTHERMAL POWER PLANT

Prime Minister John Key was on hand to mark the official inauguration of Ngatamariki Geothermal Power Station, the largest singular binary power plant ever built. The US\$416 million project is located 15km north of Taupo and was a joint venture between Mighty Power River and Tauhara North No2 Trust. Construction of the site began in July 2011 and was completed in September this year. The 82MW station will generate enough electricity to power 80,000 households, bringing geothermal electricity generation capacity in New Zealand up to 854MW. Geothermal energy produces 13% of New Zealand's energy supply and will expand further upon completion of the 166MW Te Mihi power station later this year. The government has aimed to achieve a renewable energy share of 90% by 2025, up from 70% at present. New Zealand's geothermal sites are largely concentrated in the Taupo Volcanic Zone in the North Island.

EUROPE KEEPS APACE AS LEADER IN SOLAR PANEL INSTALLATIONS

Europe installed 16.8GW of new solar capacity in 2012, accounting for 51.7% of solar panel installations worldwide. Germany led the region with 7.6GW of added capacity, a slight increase from the 7.5GW recorded in 2011. Italy installed more than 3.5GW, bringing cumulative installed capacity to 16.4GW. Total capacity across Europe now stands at 69GW, which satisfies 2.4% of the region's total demand. Despite a 24% decrease in the price of solar PV modules, global investment in the solar industry fell 9%. EU growth was hindered by the ongoing economic crisis in Italy and Spain, which have the second and third-highest cumulative installed capacity. The future outlook of the European solar market remains positive, with added capacity expected to reach 126.8GW in 2017. However, Europe is likely to lose its dominance to Asia, which will account for 48% of market share by the end of 2014.

Global Energy Affairs

Vol. 1, No. 3, October 2013

Publisher

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gea@globalenergyinitiative.org

866 United Nations Plaza
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 United States of America
 PH: 212.574.8138
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Nuclear Policy in the UK: The Spirit is Willing but the Market Is Weak

Malcolm Grimston

Nuclear power in the UK is in a complex and unpredictable environment. After a decade where very little new capacity of any description has been built, the UK is in growing need of a major program of new electricity capacity. The government has introduced 'Electricity Market Reform' (EMR) in an attempt to persuade investors to build low-carbon technology to fill the requirements of security of supply and falling greenhouse gas emissions. EMR includes long-term price guarantees at above-market levels for low-carbon generating capacity; a 'floor' to the traded carbon price in the long term; and capacity payments to compensate dispatchable generators for loss of market when variable renewables are generating. Despite this, throughout 2013 the government and potential investors EDF have been in protracted discussion about future price guarantees.



On the one hand nuclear power is recognized as the main dispatchable low-carbon technology—a new nuclear station could replace a Combined Cycle Gas Turbine (CCGT) or coal-fired power station in a way that investment in windpower, say, could not. Its system-level costs (i.e. the ultimate costs to consumers, irrespective of how those costs are allotted among generators, grid companies and customers) are much lower than those of the variable renewables. A major program of new reactors would safeguard future generations from the dangers of very high power prices caused by a growing dependence on imports of gas, in a world where the growing economies of the Asia-Pacific and perhaps Africa and South America are also increasing their imports. Its industrial implications for the UK are potentially highly positive—most of the economic benefit of a new CCGT would go overseas (as most of the cost of the electricity generated would be represented by imported gas), while more than 50% of the value of even the first new nuclear stations would be sourced from UK companies, with beneficial effects on employment and the balance of payments.

Nuclear power has strong political support—in March 2013 the then Energy Minister, John Hayes, said: "The government is determined to see new nuclear play a role in our future energy mix, as it does today. Already, companies have set out plans to develop new reactors at five sites across England. This includes receipt of the first planning application for a nuclear power station since the 1980s at Hinkley Point and the signing last year by Hitachi of a US\$1.05 billion deal to build up to six new reactors. We're focused on bringing forward this investment." In September 2013 the traditionally antinuclear Liberal Democrats reversed their position. Despite Fukushima, public support has remained firm. Local authorities and politicians in areas expected to host new nuclear plants—all of which have had nuclear plants in the past—have been highly supportive of plans for new build.

However, such observations are of little interest per se to investors considering investing in the power sector today. Managing the short-term to medium-term financial risks of that investment is of much more concern—*continued on page 13*

Tracking the Progress of Masdar City



Back in 2006, the UAE announced plans to build the world's first zero carbon, fossil fuel car-free city. Masdar Institute, the designers and architects of the project had envisioned a city that would be powered entirely on renewable energy, where residents would be transported around in podcars through a personal rapid transport system (PRT). Since then, the project has been pushed back due to the financial crisis and is expected to be complete by 2025. The PRT system has been shelved for the time being and the city now aims to be low-carbon. Despite the scaled-down ambitions of Masdar City, it remains a visionary prototype for future sustainable living.

The US\$18-19 billion mixed-use development is currently in its first phase of construction, which is scheduled for completion in 2015. A key component is the 100,000sqm Masdar headquarters building, the first large-scale positive energy building. The building will house the secretariat of the International Renewable Energy Agency in addition to corporate and commercial entities. It has been designed by Adrian Smith + Gordon Gill Architecture and will be powered by 15,590 photovoltaic panels.

Meanwhile, Masdar Institute of Science and Technology, the city's first tenant is ongoing efforts for the second phase of construction. Phase two will provide 45,000sqm of gross floor area, including three residential, three laboratories and one recreational building.

The Institute already has six fully operational buildings and recently completed the 10,000sqm Courtyard Building. There were 417 graduate students enrolled as of September 2013, including 162 UAE nationals.

Hilton Worldwide is the latest foreign tenant to join Masdar City after signing an agreement with Reliable Property Investment to build a 316-room hotel under the firm's DoubleTree brand. In conformance to the city's green vision the hotel will seek to achieve the Estidama 3-pearl rating, which is the equivalent of the LEED standards developed by the US Green Building Council. DoubleTree by Hilton Abu Dhabi Masdar City is scheduled to open in 2017.

While the world awaits the final completion of this futuristic city, Masdar has opened its doors for the general public to witness a city in the making. Visitors should however take note to leave their fossil-fuel private vehicles at the city perimeter, since only electric vehicles are permitted to enter.

“When it comes to the cause of climate change, 74% believe that deforestation is a significant contributing factor. Oil ranks second at 63% and coal follows with 59%.”

Sheril Kirshenbaum

Audi Ushers In New Generation of E-Gas Sustainable Mobility



- ▶ Audi's first natural gas production vehicle
- ▶ **Bivalent configuration:**
Cruising range natural gas > 400 km
Cruising range on gasoline: > 900 km
- ▶ Market launch **End of 2013**
- ▶ Price in Germany: **EUR 25,900**

German car manufacturer Audi has been accelerating its foray into sustainable mobility in recent years, inaugurating the first e-gas plant in June and releasing new energy efficient car models. Their efforts have not gone unnoticed either, with RobecoSAM recently crowning parent company Volkswagen Group as the most sustainable automaker in the Dow Jones Sustainability Index.

The e-gas plant in Werlte, Germany signals a revolutionary step in carbon technology. Audi cites itself as the first automobile manufacturer to develop a chain of sustainable energy carriers. The process requires three inputs: green electricity, water and carbon dioxide. It involves a two-step process of electrolysis and methanation, whereby hydrogen is reacted with carbon dioxide. The end product is Audi e-gas, which is being used to fuel the manufacturer's line of vehicles such as the A3 Sportback g-tron. Audi expects to produce 1,000 million tons of e-gas annually and will distribute its e-gas into the grid system starting Fall 2013.

Audi's A3 Sportback g-tron was showcased for the second time at the Frankfurt motor show last month. The model uses less than 3.5kg of e-gas per 100km, with fuel costs in the ballpark of US\$5.40 over the same distance range. Customers can order a quota of e-gas upon purchase of the vehicle, which is a mechanism to ensure that the adequate amounts of the fuel are fed into the grid system. The A3 Sportback g-tron will be released on the market in Europe during 2014 at a starting price of US\$49,043.

The increased momentum towards sustainable mobility comes at a time of flagging sales for fossil-fuel vehicles. New car registrations in the EU fell to a 20-year low in August, with 653,872 vehicles sold that month. The burgeoning market of electric and hybrid vehicles signals increased demand for cost-effective solutions for private car ownership, as well as societal awareness about the impact of fossil fuels on the environment.

Your Opportunity to Speak at UN Headquarters

**GLOBAL SUSTAINABLE ESSAY
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• **New Solar Energy Installations Expected to Outpace Wind Power This Year**

New solar photovoltaic capacity worldwide will reach 36.7GW this year, outpacing wind energy for the first time ever. Wind power installations for the year are expected to amount to 35.5 GW, according to Bloomberg New Energy Finance. Wind energy growth has been stalled by a decrease in demand in China and the U.S, allowing the market for solar PV to take the lead. Global demand for wind turbines in 2013 is expected to shrink by 25% to the lowest levels since 2008. Despite this temporary loss of momentum, wind power will remain a leading renewable energy option. The long-term outlook for wind energy remains positive as countries look towards offshore wind options and the price of wind technology continues to decrease.

• **US\$100m Investment Fund to Support Renewable Energy in Southeast Asia**

Malaysia's Prime Minister Najib Razak has announced the launch of an investment fund to bolster renewable energy business development in Southeast Asia. The government is partnering with Japan-based Asian Energy to provide funds for small and medium-sized businesses and will be administered by Malaysian fund management company Putra Eco Ventures Inc. Putra Eco Ventures will also provide business consulting services to green companies. The investment fund is a stepping-stone that will help Malaysia meet their goal to cut carbon emissions 40% by 2020 compared to 2005 levels. The nation also aims to increase renewable energy capacity to 4 GW by 2030.

• **Asia Development Bank to Finance US\$500 Million Renewable Energy Transmission System in India**

The Asia Development Bank will provide US\$500 million to build a transmission system in Rajasthan that sends electricity from wind and solar projects to state and national grids. The transmission system will encompass 1,850 km of transmission lines, three new 400 kilovolt substations and nine kilovolt grid substations. Funds from ADB will also be used to boost the transmission capacity of seven existing substations. Development of solar energy is a key component of the government's Jawaharlal Nehru Solar Mission to find alternatives to fossil fuels and meet India's rapid growing

energy needs. A large portion of solar capacity is expected to be located in Rajasthan, which has one of the highest levels of solar radiation in India.

• **Scotland Gives Approval for Europe's Largest Tidal Energy Project**

MeyGen Limited has been granted permission to develop the largest tidal array in Europe. The Scottish government will provide £13 million in funding to support the wave energy project, which is located in the Inner Sound of the Pentland Firth. A demonstration with a 6-turbine array will be built between Orkney and the Scottish mainland. Once complete, the 86MW array is expected to produce enough electricity to power 42,000 homes. The site has the potential to yield up to 398 MW of energy. Carbon Trust has estimated that the wave and tidal resources could provide 20% of the United Kingdom's electricity needs if fully developed.

• **Sinopec and PDVSA to Invest US\$14 billion in Venezuelan Oilfield**

Chinese state-owned oil company Sinopec and Venezuela's PDVSA have signed an agreement to invest US\$14 billion in the development of Junin 1 oilfield for production of 200,000b/d. The oilfield is located in the Orinoco belt in eastern part of the Venezuela and is estimated to hold nearly 300 billion barrels of oil. Last month, China's largest integrated energy company CNPC invested an equivalent amount for a project in the Junin 10 block that is expected to yield 220,000b/d. Venezuela and China are established trading partners, with the former shipping more than 600,000b/d of oil to China, or a quarter of its total crude oil exports.

• **China Invests More Than US\$50 billion in Energy Deals Across Central Asia**

China has cemented its role as an economic driver in the region, with President Xi Jinping securing energy agreements with Turkmenistan, Uzbekistan, and Kazakhstan during his recent visit to Central Asia. Turkmenistan will increase Chinese exports of natural gas to 65 bcm by 2020, up from 20 bcm in 2012. The two countries are jointly developing a project in the Galkynysh field and recently completed the first phase of construction. In Uzbekistan, President Islam Karimov and Xi signed a US\$15.5 billion

deal for 31 oil, gas and uranium projects. The agreement includes the construction of another oil pipeline, bringing the total to four. Kyrgyzstan and China 22 signed agreements worth a combined US\$30 billion, including a US\$5 billion deal for China's CNPC to obtain an 8.33% stake in the Kashagan Oil & Gas field.

• **Australia Introduces World's First Solar-powered Public Transportation**

The city of Adelaide is ushering a new generation of clean vehicles, unveiling the world's first 100% solar-powered electric bus. Translated from the Aboriginal word for "sun", the Tindo has a unique design since there are no solar panels on the bus. Instead, the electric bus is charged from electric power generated by solar panels at the city's central bus station. Charging the Tindo will provide enough energy for the bus to drive freely between the city center and North Adelaide. The bus service is being offered free of charge as part of Adelaide's public transportation system. It was commissioned from Designline International as part of the City Council's Strategy Plan 2012-2016, which includes a comprehensive network of footpaths, bike trails, and public transportation to enable citizens to get around without a car.

• **Solar Energy for 70,000 Tanzanian households**

The African Development Bank and World Bank have approved an investment plan to boost small-scale solar investment in 10 rural Tanzanian districts. US\$25 million of funding will come through the African Development Bank/Climate Investment Funds' Scaling-up Renewable Energy Program. An additional US\$50 million of credit will come from the International Development Association, an arm of the World Bank. Half of the funds will be targeted towards the Renewable Energy for Rural Electrification (RERE) scheme, which aims to drive off-grid solar projects in yet unidentified locations. Under the scheme, suppliers will bid to supply PV energy to public institutions. The RERE scheme is set to come into effect by early 2015.

The Power of Public Opinion: How They Define Global Energy Priorities

Sheril Kirshenbaum



Public opinion on energy shapes future policy decisions, but attitudes are not always based on facts alone. Instead, they fluctuate due to media coverage, political volleying, economics, climate change, and even celebrities, family, and friends. The biannual University of Texas at Austin Energy Poll suggests we are in a transformative period for American attitudes on energy. Aggregate perceptions matter because they influence our elected representatives, and in turn, define global energy priorities.

The domestic energy mix in the United States is changing. Natural gas may surpass petroleum as our dominant energy source within one or two decades and some consumers are taking notice. Demand for natural gas in vehicles has risen significantly in recent years because it has been billed as a cleaner and less expensive alternative to gasoline. Between September 2011 and September 2013, the percentage of Americans who say they are likely to own a vehicle that runs on natural gas within the next five years jumped from 15% to 22%.

The abundance of natural gas available is largely due to advances in horizontal drilling deep underground through hydraulic fracturing. In September 2013, 40% of Americans were familiar with the terms “hydraulic fracturing” or “fracking,” up from 32% during March of the previous year. The

proliferation of new gas wells and an increase in media attention may be responsible for raising awareness, but this game changing technology still remains relatively obscure to over half of the public. Among those who are familiar with hydraulic fracturing, support for its use to extract fossil fuels decreased by 10% between March 2012 and September 2013 from 48% to 38%. Meanwhile, 43% currently say there should be more regulation on hydraulic fracturing, up from 38% 18 months ago.

Increasing numbers of Americans are considering the adoption of renewable energy alternatives. In some cases, the technology has been available for decades, but recently gained wider appeal. Between September 2011 and September 2013, interest in installing solar panels at home within the next five years climbed from 21% to 28%. Meanwhile, Americans expecting to use smart meter technology increased from 38% to 45%.

Shifting attitudes on renewables may reflect perceived improvements in energy efficiency, reduced costs, or climate concerns. Other influential factors might be the higher visibility of renewables in popular culture and wider array of options now available to consumers. Weather may play a role as well given that the greatest rise in interest occurred during the summer of 2012, a record season of

storms and droughts in the United States.

By September 2013, 72% of Americans considered energy efficiency a priority to them personally. There has also been movement on several additional issues related to the environment. Support for approval of the Keystone XL pipeline, which would carry millions of gallons of crude oil from Canada to Texas refineries, decreased from 50% to 42% between March 2012 and September 2013. Likewise, there was a six-point decline among those who favor expanding offshore oil development in the Gulf Coast of Mexico from 46% to 40% during that time.

On the topic of global climate change, attitudes also appear to be shifting. The percentage of Americans who say climate change is occurring increased from 65% in March 2012 to 72% in September 2013. However, climate remains a politically charged topic, with 87% of Democrats and just 52% of Republicans convinced that it is taking place. Overall, 61% of Americans say they would be more likely to vote for a candidate in the next presidential election who supports taking steps to reduce carbon emissions.

When it comes to the cause of climate change, 74% believe that deforestation is a significant contributing factor. Oil ranks second at 63% and coal follows with 59%.

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The power of public opinion: how they define global energy priorities

continued from page 9

Nearly 44% of Americans say non-anthropogenic reasons play a role in climate change and 41% attribute natural gas to warming temperatures. Just 37% consider agricultural practices to be a cause of climate change.

While we can never be sure what nudges public opinion on energy in one direction or another, we know Americans are paying more attention to energy issues than in the past. By September 2013, 31% considered themselves knowledgeable on how energy is produced, delivered and used, up from 24% two years ago. Polls allow us to observe when opinions change, but they fall short of reliably predicting what happens next. A flood, oil spill, nuclear disaster, or new energy technology could each independently influence public attitudes enough to shift the global energy conversation in new directions. Such major world events define how the United States and other nations will choose the next set of energy priorities, strategies, and solutions. •

Sheril Kirshenbaum is Director of The Energy Poll at The University of Texas at Austin. Her writing has appeared in publications such as Bloomberg and CNN frequently covering topics that bridge science and society from hydraulic fracturing to climate change. Her work has also been published in scientific journals including Science and Nature and she is featured in the anthology The Best American Science Writing 2010.

The views and opinions expressed in this article are those of the author and do not necessarily reflect the views or policies of GEI



The YPSEA group is comprised of young professionals age 20-40, who come from a wide range of professions - academia, government, business, nonprofit and others.

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The program gives a glimpse into establishing professional careers in the field of energy and also gives them the unique opportunity to network with government officials and energy experts.

To express your interest in YPSEA, please send your resume to info@globalenergyinitiative.org along with a brief statement about why you want to join the group.

Quayle Hodek: From 23-year-old CEO to Respected Leader in Renewable Energy



The rise to prominence of Renewable Choice Energy follows an unexpected tale of success. Its founder, **Quayle Hodek** was only 20-years-old when he shocked his parents by deciding to drop out of college at the University of Wisconsin, where he had been attending on a full academic scholarship. Riding on the momentum of the dot-com hype he founded Zoom Culture, a video-sharing social network similar to YouTube. The enterprise collapsed following the dot-com burst, but Hodek wanted to take the lessons from this initial failure to start a meaningful new venture.

Three years later, Hodek combined his fascination with renewable energy and entrepreneurship to start Renewable Choice Energy along with his two closest friends. The concept itself was simple; they believed that given the choice, individuals or companies would be willing to pay a premium for wind energy. However, the political and economic predicament caused by the September 11 attacks presented a challenge for Hodek and his team. Wind energy was also a new and unproven form of energy, creating additional barriers to overcome.

The big break came in 2009, when Whole

Foods Market signed a deal with Renewable Choice Energy to purchase 776 million kWh of wind energy credits. It was a significant milestone for both parties, with Whole Foods Market becoming the first major retailer to power 100% of its energy using wind energy credits.

While the timing of Hodek's first start-up was seemingly premature, his second emerged at a pivotal point in energy history. The market for renewable energy was booming and wind energy was becoming cost competitive with fossil fuels. Fortune had swayed in Hodek's favour and his business was flourishing; yet he felt an unfulfilled sense of achievement.

Hodek had a moment of awakening while listening to a lecture by Juan Fermín Rodríguez at the Unreasonable Institute. He was moved by Rodríguez's mission with QUETSOL to provide miniature solar panels to impoverished families in Guatemala. The fact that these solar panel systems could serve as a cheaper alternative to candles was unconceivable. Through the Institute, Hodek was able to connect with Rodríguez and found his next mission—to use renewable energy solutions to impact communities directly.

Fast-forward to the present and Hodek's clients include 50 of the Fortune 500 companies. Renewable Choice Energy continues to expand as a renewable energy provider. Most recently, the firm launched its new subsidiary company Mosaic Labs, which will provide consulting services in sustainability reporting and disclosure, strategy development and supply chain engagement.

When asked about the factors behind Renewable Choice Energy's success, President and Co-Founder Kris Lotlikar said, "Quayle Hodek is one of the most passionate environmentalists I know. His dogged pursuit of a clean energy future is unparalleled in our industry. It's this tenacity that's helped him to build Renewable Choice Energy from its humble beginnings in our basement into the successful, innovative, global firm that it is today." •



Roel Swierenga

Chairman, Hansa Green Tour

Sustainable mobility 2014-2024

With a growing world population and more people that are now able to buy the total demand for cars is growing. This will cause more traffic congestion

and air pollution problems especially in fast growing cities. Therefore a transformation from traditional fossil fuels to cleaner and more sustainable ways of propulsion is needed.

For a major transition to environmental friendly mobility it is important to offer the same amount of comfort, reliability, ease of use and at a fair price. E-mobility can offer solutions for urban areas but for longer distances or remote areas other solutions will be needed. Intelligent lightweight hybrid systems with range extension could offer the best of both worlds. Compressed natural gas (CNG) and especially biogas (BIO CNG) made from waste streams or renewable energy sources can play a major role in this transition to more sustainable mobility. Using waste streams to produce biogas for transportation will help to reduce the total amount of waste and improve air quality in inner cities immediately due to very low emissions. When electric vehicles are combined with a biogas range extender we can make a major step to climate friendly mobility.

LIGHT UP A VILLAGE CAMPAIGN

The Light up a Village project aims to provide electricity to energy impoverished populations through sustainable means.

Through lighting up lives, sponsor companies will enhance their profile as socially responsible companies, while transforming the lives of the recipient villagers

LEARN MORE ABOUT THE CAMPAIGN

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Latest Developments in the World on Energy

Study finds renewable energy patents on the rise

Patents for renewable energy technologies have increased sharply over the past decade, according to a joint study by MIT and the Santa Fe Institute. Wind energy patents worldwide increased by 19% annually between 2004 and 2009, while solar patents increased 13% annually over the same period. Japan issued the most number of solar photovoltaic patents between 1970 and 2009, followed by the US and China. In the US, renewable energy patents averaged 200 annually between 1975 and 2000. By 2009, this had increased to more than 1,000 patents issued. The study examined 73,000 energy patents from 100 countries between issued between 1970 and 2009.

New Bioenergy Technology to Convert Wastewater into Hydrogen Gas for Energy

Researchers at Lawrence Livermore National Laboratory and Florida based Chemergy Inc. plan to trial new bioenergy technology that will convert byproducts from a wastewater treatment plant into hydrogen gas for electricity. The demonstration project is scheduled to begin in mid-October and will be conducted on a limited industrial scale at the Delta Diablo Sanitation District in Antioch, CA. Eventually, the plant is expected to process 1 ton of wet biosolids daily and produce 30 kW of electricity. It is predicted that the technology will convert biosolids into hydrogen gas for less than \$2 per kW. Researchers are confident that the project will foster more widespread use of biosolids for energy production.

Researchers Develop Brighter, More Energy Efficient LEDs

Researchers at Hong Kong Polytechnic University's Department of Electronic and Information Engineering have developed an innovative driver that will provide power for light bulbs. Dubbed multi-level pulse-width modulation (multi-level PWM), the pulse operation was redesigned to maximize light output while minimizing energy loss through heat. The new design will conserve energy

by up to 15% and has a higher lumen per watt. Energy savings from using the multi-level PWM are significant, especially when scaled-up for large-scale applications. The multi-level PWM also offers additional advantages over conventional LEDs, such as higher light quality.

Frozen Smoke Helps Buildings in Bavaria Save Energy

The Bavarian Center for Applied Energy Research has designed a unique method for providing thermal insulation by using "frozen smoke" Lumira Aerogel in their roofing system. The aerogel was created by Cabot, a Boston based company, and produces insulating particles that are composed of more than 90% air. The Center's translucent roof is insulated with a layer of glass-fiber reinforced polyester panels that are filled with Lumira. According to Cabot, the aerogel delivers a higher thermal performance and light diffusion compared to untreated glass. The aerogel can be applied on walls, flooring and roofs to will help buildings achieve higher ratings for sustainability.

Energy Efficiency Solutions with a Mobile App

Underwriters Laboratories has released the latest version of its LightSmart mobile app, which helps individuals and organizations realize the benefits of switching to more energy efficient light bulbs. LightSmart 1.5 features a new function that allows users to calculate the ROI for upgrading to more energy efficient lighting. The ROI compares the cost of the upgraded lighting system to incandescent light bulbs, which have a lower upfront cost but are more expensive in the long term. To account for variations in the price of LED bulbs, the app enables users to input the replacement cost to ensure an accurate ROI. Additionally, the app calculates how their lighting choices can help to reduce carbon emissions.

Proctor & Gamble Sees the Benefit of Energy management Program

Proctor & Gamble is realizing the financial returns of its 'smart energy' project, reporting overall savings of 10% after 11

months of testing. The pilot program was implemented in 12 of the firm's buildings, including P&G's global headquarters in Cincinnati. The smart energy technology program, named IntelliCommand was used to provide around-the-clock remote facility monitoring and control across multiple locations. P&G managed to recoup their initial investment after three months of the trial and experienced the highest energy savings in the firm's technical center pilot site

Siemens and Aquion Energy to Integrate Technology for Energy Storage Systems

Siemens and Aquion Energy have signed a memorandum of understanding that will test the integration of Aquion's Aqueous Hybrid Ion (AHI) battery and Siemens' Sinamic's S120. The partners intend to develop an AHI-based energy storage system that will be scalable on an industrial level. Aquion Energy manufactures batteries using a unique saltwater electrolyte technology. These innovative batteries have the potential to provide cost effective and energy efficient storage for renewable support functions. The collaboration with Siemens is a pivotal step for Aquion, who is planning on ramping up commercial production in the first half of 2014.

Electric vehicles top auto sales in Norway

Electric vehicles captured 8.6% of the auto-market in Norway for the month of September, an increase from 5.2% the previous year. The Tesla S topped car sales for the first time with 5.1% of new car registrations. Norway imposes a high import tax on foreign vehicles, however electric vehicles are tax exempt. This tax exemption makes high end Teslas cheaper than comparable luxury cars. Tesla is investing in Norway's electric vehicle infrastructure and launched their first European Supercharger station in August. They have since unveiled six new charging stations along popular routes between Oslo and Trondheim. Approximately 90% of Norwegians live within 320 km of a charging station.

Global Energy Headlines

- New York, London and Paris could be uninhabitable in 45 years, according to a recent study by scientists at the University of Hawaii. By 2050, anywhere between 1 and 5 billion people will live in areas that are experiencing unprecedented climate conditions.
- Cumulative consumer spending on green energy subsidies in Germany will exceed US\$136 billion next year. The government recently announced that it is increasing the renewable energy surcharge by 18% to 8.46 US cents per kWh.
- China's electricity consumption increased 10.4% year on year in September to 444.8 billion kWh. Annual consumption for 2013 is expected to grow 9% from the previous year, while economic growth is estimated at 7.5% for the year.
- Installed capacity of hydropower worldwide is expected to reach 1,407 GW by 2020, compared to 1,064 GW in 2012. More than 60 countries currently satisfy more than half of their energy needs from hydropower.
- Global investment in clean energy fell to US\$45.9 billion in Q3, down 14% from the previous quarter. Renewable projects were affected by curbed subsidies in Europe and cheap natural gas in the US.
- Energy consumption in the MENA region is predicted to rise 114% by 2050, according to a report by the World Energy Council. World energy consumption will increase between 27-61% from 2010 and 2050.
- Asia-Pacific nations will need to invest US\$11.7 trillion in energy in the 25 years up to 2035 to satisfy growing energy demand in the region. China and India will need US\$5.7 trillion and US\$2.4 trillion, respectively.
- Improved energy efficiency and rising domestic oil and gas production will halve US oil imports by 2020, says the IEA. Energy savings will reach 3,000TWh in 2020, up from 1,000TWh in 2011.
- Britain has announced that it will allow China to buy majority stakes in British nuclear power plants. The two nations recently signed an MOU on nuclear cooperation that also covers training for Chinese technicians.
- Thailand's energy demand is expected to increase 2.3% per annum between 2010 and 2035, according to ADB. Oil will satisfy 39.5% of the country's energy needs in 2035, while natural gas will supply 28.8%.
- A ruptured pipeline has spilled crude oil into a wheat field in North Dakota, becoming the largest oil spill on US soil. Tesoro Corp. estimates that more than 20,000 barrels have been leaked.
- Switzerland tops World Energy Council's energy sustainability index for 2013. Countries are ranked based on energy supply management, energy accessibility and renewable energy share.
- Ghana will begin construction on Africa's largest solar plant in 2014. The 155MW Nzema array is being developed by the UK's Blue Energy and will generate enough energy to power 100,000 homes.
- China will double power capacity by 2030 in order to satisfy the country's growing demand for energy. Coal will continue to supply more than half of China's energy needs.
- Japan's government has developed a joint credit mechanism tool to help developing countries combat climate change by utilizing low-carbon technology and services. It has signed bilateral JCM agreements with seven countries to date.
- Russian oil production climbed to 10.53 million b/d in September, matching the post-Soviet record high that was set earlier in June. Saudi Arabia, the world's largest oil exporter reported total production of 10.05 million b/d.
- China is planning to build a US\$30 billion coal gasification plant in the Xinjiang Uygur Autonomous Region that will produce 30 billion cubic meters of gas annually.
- Renewable energy in Europe is expected to grow at a compound annual rate of 8.6% from 2013-2020, according to a report by GlobalData. Rising electricity demand and region-wide initiatives to reduce carbon emissions are driving the push for renewables.
- British households will pay an average of US\$464 more over the next six years to pay for US\$35.2 billion worth of subsidies for renewable projects. Analysis by Taxpayers Alliance shows that the UK spent US\$3.24 billion on renewable subsidies in the 2012-2013 financial year.
- Energy demand in Peru is expected to increase by 6% annually over the next decade. The country has added 1.4GW of capacity this year to keep up with growing demand.
- Chile's President Sebastian Piñera mandating that utilities source 20% of their electricity from renewable sources by 2025. The law specifically excludes large hydroelectric projects as a source of renewable energy.
- Mexico aims to increase the amount of energy generated from renewable sources to 35% by 2026. At present, only 1.5% of Mexico's energy is generated from solar and wind sources. The government predicts an increase of 2,170 MW by the end of the decade.
- South Africa fuel producers will be required to blend petrol and diesel with biofuel, starting from October 1, 2015. Despite a 50% rebate on the general fuel levy for biodiesel manufacturers, South Africa has struggled to develop its bio-fuel industry.

Nuclear policy in the UK: The spirit is willing but the market is weak

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risks which can be categorised as financial (stemming from the highly capital intensive nature of nuclear power, requiring long-term price guarantees), construction (sharing the risk of schedule and cost overruns with consumers or taxpayers) and regulatory (over-complex planning processes and the political risk of policy change in the future owing to a change of government or major incident overseas).

Anything resembling a 'free market' which did not fully value the externalities such as climate change emissions, security of supply and indeed long-term power price stability would in all likelihood build mainly CCGT, though it may well hedge its bets with some nuclear and perhaps dispatchable renewables such as biofuels or hydropower. (Even hydropower is vulnerable to periods of particularly low rainfall.) Variable renewables would look very unattractive indeed. As the EMR process shows, government has to work extremely hard to create a set of market rules which would attract private investment into these expensive, long-term schemes.

Two questions emerge. In order to ensure the societal benefits of a nuclear power program, would government have to intervene in the market so heavily that in effect the risks of investment were nationalized but the potential benefits privatized? And even if it did, how credible would potential investors regard a regime which in principle could be undermined by future changes in the market rules or by changing government attitudes to nuclear power, such as was seen in Germany after the Fukushima accident in 2011? Experience of

the last 25 years in the UK suggests such a regime might be expected to undergo major changes roughly every 12 years; a nuclear plant order in 2014 might well still be generating electricity in 2080.

It may be that the challenges of providing secure, environmentally sensitive long-term electricity supplies are simply too complex to be delivered within a market context. Circumstances in the UK seem to be highly favorable towards new nuclear development—cross-party support in Parliament, a government which wishes to launch major infrastructure program as a response to the recession considerable public support, a much improved planning and licensing regime and companies interested in making the investment. If despite such an environment a major program of nuclear power new build is not initiated then it may be time to review the fundamental role of markets in the area. •

*Dr. Malcolm Grimston is an Honorable Senior Research Fellow at Imperial College London. He has written extensively on energy and nuclear policy matters, including two books co-written with the late Peter Beck: *Double or Quits—the global future of civil nuclear energy* and *Civil nuclear energy—fuel of the future or relic of the past?**

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exports net power to France.) Renewables rose to 23% of generation, passing every rival except lignite (soon to fade as its subsidies end). Wholesale prices plummeted 30% in two years to near 8-year lows, attracting energy-intensive industries. Real GDP, damped by the Eurozone crisis, grew just 0.7%, but electricity use fell 1.3%. Power plants and industries emitted no more carbon. Weather-adjusted total German carbon emissions fell, though a frigid winter raised absolute emissions 1.6%.

The bottom line: since German reunification in 1990, real GDP rose 37%, weather-adjusted primary energy use fell 11%, and carbon emissions fell 25.5%. By 2050, Germany intends to cut carbon emissions 80–95% compared to 1990 levels, double its total energy productivity from the 2020 level, and produce 60% of its total final energy consumption from renewable sources.

Giant utilities, their profits squeezed and business models upended by the renewables they bet against, mounted a vigorous disinformation campaign. Critics claimed Germany had replaced lost nuclear power with coal. Actually, the brief and modest coal uptick was due to pricier gas and a flood of American coal displaced by cheaper gas in the United States (and, nearly twice as importantly in 2012, more-efficient energy use). German coal-burning remained below its 1990–2007 high, no new coal plants were ordered, and the few added units generally shut down more, less-efficient, and dirtier coal-plant capacity.

Critics claimed German industry was fleeing—it wasn't—and renewables were destabilizing the grid—they're not. Big German industries continued to enjoy highly reliable and ever cheaper electricity: their political patrons generously exempted them both from grid fees and from paying for the renewable expansion that slashed wholesale power prices. This favoritism modestly raised the renewable surcharge on households (whose bills are half taxes), inspiring the absurd election-season fiction that renewables have made electricity a luxury good and tipped Germany's poor into energy penury. All untrue—yet on 18 September 2013, even The New York Times echoed Der Spiegel's breathless fabrications.

Germany isn't the only renewable success story: Denmark's 2012 electricity was 41% renewable, and in the first half of 2013, Spain averaged 48% and Portugal 70% renewable (up from 17% in 2005). A solar power boom is evading utility barriers in Japan. Last year, China made more electricity from wind than nuclear power, and added more electric generation from non-hydro renewables than from all fossil-fueled and nuclear plants combined.

Half the world's new generating capacity has been renewable since 2008. Today, three of the world's top four economies—China, Japan, and Germany, as well as India—produce more electricity from non-

hydro renewables than from nuclear power. Globally each year, non-hydro renewables win a quarter-trillion dollars of private investment and add more than 80 billion watts. Electric generators have become a modular mass-producible manufactured product, scalable even faster than cellphones. This accelerating revolution provides strong market evidence that efficiency and renewables can protect the climate not at a cost but at a profit, because saving or displacing fossil fuel costs less than buying it.

Thus a 2.6-fold bigger 2050 U.S. economy could eliminate coal, oil, and nuclear energy and reduce natural gas use by one-third, triple energy efficiency, shift from one-tenth to three-fourths renewable supply, emit 82–86% less carbon, and save \$5 trillion. This could all be achieved without new inventions or Acts of Congress, the transition led by business for profit. That blueprint (detailed in our business book *Reinventing Fire*) and the European Climate Foundation's similar Roadmap 2050 show how climate change, energy insecurity, energy poverty, and nuclear proliferation—four key threats to global security and prosperity—are artifacts of not choosing the best buys first. But even America is shifting: its electricity and gasoline demand peaked in 2007, and electricity per dollar of GDP fell 3.4% in 2012 alone.

Carbon pricing and international agreements could help achieve these goals, but China had its own reasons for making energy efficiency its top strategic priority for national development back in 2005: rather, her leaders understood that otherwise their nation couldn't afford to develop. Efficiency needs about 10,000 times less investment than expanding electricity supplies. Buying cheap negawatts (saved watts) instead of costly megawatts could turn the power sector from a black hole, gobbling a fourth of global development capital, into a net exporter of capital to fund other needs. That's the biggest lever ever discovered for global development, and the greatest bonanza for private enterprise—if only we see it and let it flourish. •

*Physicist Amory B. Lovins is cofounder and chief scientist of Rocky Mountain Institute (rmi.org), which transforms global energy use to create a clean, prosperous, and secure future. He is a member of the National Petroleum Council, an advisor to the Chief of Naval Operations, and in 2007, one of *Time's* 100 most influential people in the world and *Foreign Policy's* 100 top global thinkers.*

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