AMERICAN ENERGY SOCIETY

*The expert network for energy*

# Energy Matters

*The trusted source for sound-bite summaries of the energy news you need to know.*

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## *News from the Society*

- **New website**: The American Energy Society is proud to announce the launch of its new and improved **website**. Visit the site for daily updates of news, announcements, opportunities and offers, including *one last chance to invite a colleague(s) to* **JOIN the Society for FREE.**
- **Award winners**: The new AES website lists the Member-nominated **top web-based energy-related resources**. See also the featured awards in this e-newsletter, including: the XPrize, CTO, and Techstars.
- **Free publications**: Members of AES have FREE access to **Energy Online!** through publishing partner DeGruyter (offer good through 2018).

## *Headline News*

### *Conventional*

Petroleum

- Oil production in Texas will probably double over the next few years; however, there is only about 160,000 bpd of additional space in the US south/Texas pipeline system, about 4 percent of Texas' total output. In other words, **the Texas pipeline system is at maximum capacity** and cannot support planned increases to production.

- *Breaking news:* Using new digital technologies, **Bahrain has just discovered 80 billion barrels of shale oil offshore.** To put that into perspective, that is the amount of Russia's entire reserve.

Gas

- **The EU is a net importer of energy** (imports > exports). In the most extreme example, the EU imports natural gas from only 4 countries (and oil imports are only slightly more diversified):
  - Russia supplies 37.4% of the gas that is consumed by EU member states
  - Norway supplies 35.3% of all gas consumed by the EU
  - Algeria provides 13.7% of all gas into the EU
  - Qatar supplies 5.5% of EU gas

Coal

- **Planned coal retirements, 2017 - 2022 (by region and lost capacity) … [image].**

Nuclear

- **Nuclear power in the US** (the new AES website will feature nuclear power on Wednesday):
  - The US currently has more nuclear power plants than any other country in the world.
  - There are 99 operating reactors at sixty sites in the US.
  - Nuclear power provides 20% of US electricity and about 60% of all carbon-free electricity.
  - The average generation cost by nuclear power in the US is $33/MWh.
  - 40% of the nuclear power plants in the US are at least forty years old.

## *Renewables* - *Spotlight: Solar*

- **The amount of solar energy that hits the Earth in a single day could power the world for 27 years.** (Editor's note: please see *Energy Matters vol. 3(4)* for a special report on the "resource constraints" that limit the availability of solar power.)

- The LCOE ("levelized cost of electricity") for solar comes in at $70/MWh, which is about 18 percent less than the LCOE-solar from the first half of 2017. **But this global average price obscures lower costs for solar in certain parts of the world.** For instance, while the global average for solar is $70/MWh, solar in India costs $41/MWh. (For comparison, the price of coal-generated power in India is $68/MWh and $93/MWh for natural gas.)

- In 2017, **solar power attracted more investment money world-wide than any other energy technology**, reaching almost $161 billion, an 18 percent increase compared to 2016. AES Members have access to the UN study.

- **Last year, solar power generated a third of all newly generated electricity worldwide.**

- **California's fleet of large-scale solar power plants has reached a new record peak** on the California ISO grid, hitting 10,411 MW at 10:18 AM on March 5. Solar photovoltaic facilities accounted for the lion's share, peaking at 9,874 MW in mid-morning, while solar thermal hit 557 MW in mid-afternoon. (Note: see the new AES website on Thursday for more on solar.)

- **Planned solar installations in North America, 2018 and beyond (by region): [image]:**

## *Policy* - Spotlight: EPA Director Pruitt and Obama's fuel-economy standards

*Beltway Buzz*: **EPA Director Scott Pruitt is one of President Trump's most aggressive administrators.** His confrontations with clean regulations are unprecedented. In the last year, Pruitt has rescinded the waters of the US rule, pushed repeal of the Clean Power Plan, urged withdraw from the Paris climate pact, limited the EPA to clean-up of designated Superfund sites only, and, more recently, prepared revisions to Obama-era fuel-economy standards. Indeed, Pruitt's EPA has restricted or rolled back a total of 14 Obama-era environmental regulations (though California has countered nine with lawsuits). While supporting Director Pruitt's anti-regulatory approach, **the White House has a "fluid view of Pruitt's 'situations.'"** Publicly, "the president thinks that he [Pruitt] has done a good job, particularly on the deregulation front," but privately admits "the situation is… serious and we (the White House) are looking into it."

*Meanwhile*, Congress confirmed **Andrew Wheeler's nomination** as Deputy of the EPA (second-in-command).

*Why this matters now:* Director Pruitt was expected to announce the roll-back of the Obama-era fuel economy standards, but the White House has delayed the announcement since the issue is virtually guaranteed to set off a protracted legal fight that will be difficult to win in any political climate. For instance, California has a Clean Air Act waiver to enforce its own tougher auto-emission rules and a dozen other states (mostly blue) have adopted legislative standards that require following California's lead. It is also unclear if or whether the EPA Director can revoke the emission laws that were established by Congress. **At best, rolling back the emission standards will lead to a patchwork of different red-state/blue-state requirements** in different parts of the country, which would create a chaotic situation for car companies and their suppliers.

*The issue minus the noise:* Before Congress mandated the first emission standards in 1975, the average American car got about 13.5 miles per gallon. By 2016, fuel economy had roughly doubled to 25 miles per gallon. To get a sense of what that means, if Americans kept driving exactly as much as they do today **but without emission standards**, the average US household would spend nearly $2,000 more on gasoline each year and annual US carbon dioxide emissions would jump by 1 billion tons. On the other hand, **the higher emission standards will raise the price** of a car by as much as 3% (shared by the manufacturer and consumer).

*Emission standards, a comparison:* While the Obama-era standards for cars and light trucks were on pace to become some of the most aggressive in the world by 2025, they are currently **less stringent than those set by the European Union.** The following are the fuel economy targets by nation/region (by mpg for a 4-person passenger car):

1. European Union 56.8 mpg
2. South Korea 56.6 mpg
3. (tie) United States and Canada - 55.2 mpg
4. India - 49.3 mpg
5. Japan - 48.3 mpg
6. China - 47.7 mpg

## *Climate*

- **Phenological mismatch** (adjective/adverb), /phe'no-log'i-cal/ def: The warming climate changes the arrival of spring, which confuses species that rely on environmental cues to initiate natural behavior. **The following 5 species are struggling with "phenological mismatch":**

1. Orchids
2. The European pied flycatcher (bird)
3. Caribou
4. Snowshoe hare
5. Monarch butterflies

- **The Lower Mississippi River is flooding more than it has in the last 500 years**, and human interventions (such as levees) have made it worse.

- As average temperatures warm around the world, **airlines are imposing more weight restrictions** than usual. Rising temperatures cause the air to thin, which makes it harder for planes to generate lift during takeoff. Indeed, about 10 to 30 percent of all **flights scheduled during the hottest time of the year will require stricter weight restrictions.** Short runways - like those at New York's LaGuardia Airport - will be especially vulnerable.

- In 1988, Royal Dutch Shell published, "The Greenhouse Effect," an internally distributed document in which **Shell's scientists identified the threat of climate change and calculated that Shell was contributing 4 percent of global carbon-dioxide emissions.** The findings echo similar studies by other oil and gas companies in the late 1970s and early '80s. AES Members have access to a true and correct copy of Shell's **report**.

- *Breaking news:* A peer-reviewed study in *Science* suggests **there might be vast storehouses of nitrogen in the Earth's bedrock.** There may be a larger supply of nitrogen than previously believed, which runs counter to foundational ideas that inform the environmental sciences. If there is more available nitrogen, than many assumptions about the effects of global warming will have to be revisited. AES Members have access to the peer-reviewed Science **abstract**.

## *Electricity, Power, Efficiency, and Utilities*

- *Spotlight*: the **State of Global Energy and CO2, 2017** (AES Members have access to the IEA Global Energy and CO2 Status **report**):

- *World-wide demand for energy* increased 2.1% over 2016; related CO2 emission rates increased by 1.4% over the previous year. **Conclusion: "energy intensity" levels are improving** (meaning, the economy grew faster than CO2 emissions), but economic growth and carbon emissions have re-coupled again.
- *Oil* demand grew by 1.6%, more than twice the average annual rate seen over the past decade, driven by the transport sector (in particular a growing share of SUVs and trucks in major economies) as well as rising petrochemical demand.
- *Natural gas* consumption grew 3%, the most of all fossil fuels, with China alone accounting for nearly a third of this growth.
- *Coal* demand rose about 1%, reversing declines over the previous two years, driven by an increase in coal-fired electricity generation - mostly in Asia.
- *Renewables* had the highest growth rate of any fuel, meeting a quarter of world energy demand growth. The expansion of wind, solar and hydropower led growth.
- *Electricity generation* increased by 3.1%, significantly faster than overall energy demand, with India and China together accounting for 70% of the global increase.
- *Energy efficiency* improvements slowed, with global energy intensity improving by only 1.7% in 2017 compared with 2.3% on average over the last three years, caused by lower energy prices which led to greater demand and less involved regulatory policy.

- *Special report:* PJM Interconnection, the grid operator for the US Mid-Atlantic region, delivered 791 terawatt-hours of electricity to 65 million customers last year; it is the largest wholesale electricity market in the country. Among its challenges, PJM must determine the best electricity prices for *all* of its customers, a task made more difficult when some energy sources - like renewables, coal, and nuclear power - receive subsidies that temporarily push prices below market rates. Apparently, the challenge to set prices has become a burden: **PJM has filed two competing electricity price-setting policies with FERC - only once before has a regional grid operator asked federal regulators to intervene.** The **problem** is that natural gas has kept electricity prices low, creating a supply/demand imbalance that is difficult for PJM to manage.

- The University of California system (10 individual campuses, 5 medical centers; 238,000 students and more than 190,000 faculty and staff) has begun **implementing an aggressive "exit policy" from carbon producing energy sources**, including weaning off natural gas. AES members have access to the 100 page **report**. **Summary of the UC report:**

1. Increase energy efficiency.
2. Replace natural gas with biogas in the short term.
3. In the long run, electrify all end uses of energy and switch to only renewable sources.

## *Research to Markets* - Spotlight: Funding & Awards

- **Gross domestic spending on R&D** (by country/region in 2015):
    1. US - $496.6 billion (or 2.7% of gross domestic product).
    2. China - $408.8 billion (or 2.1% of GDP). Note: Chinese spending on R&D increased about 18% annually between 2000 and 2015.
    3. EU - $386 billion

(Editor's note: some analysts believe that the data provided by the Chinese for this study are rough approximations that are unreliable.)

- **The National Science Foundation unveiled a set of "Big Ideas"** that all scientists should pursue if they seek funding support from the NSF for their research. AES Members can access an **archived webinar** of "NSF's Big Ideas: Understanding the Rules of Life and The Quantum Leap" (original program: April 12 at 2:00 pm EST).

- **Featured competitions**:
    - *Cleantech*: Apply to the 2018 **Cleantech Open Accelerator** - applications due May 1.
    - *Geopolitics*: Can you create a method to predict future geopolitical outcomes? **IARPAs Geopolitical Forecasting (GF) Challenge** invites individuals or teams to develop innovative ways to forecast geopolitical events.
    - *O&G*: To celebrate its 2-year anniversary, **Station Houston** is selecting 20 start-ups for mentorship and support in Houston.
    - *Tech-to-Market:* **AES recommends Techstars Energy Accelerator.** In partnership with Statoil/Equinor, Techstars is a three-month intensive startup accelerator that supports disruptive solutions for oil, gas or renewables. Ten winners will share $120,000.

- 10 teams have advanced to the finals of the $20,000,000 NRG Carbon XPRIZE. This global competition challenged teams to transform the way the world addresses carbon dioxide (CO2) emissions through breakthrough circular carbon technologies that convert carbon dioxide emissions from power plants into valuable products. The finalists have already demonstrated conversion of CO2 into a wide variety of products, such as enhanced concrete, liquid fuels, plastics, and carbon fiber. AES Members can see the **10 teams** that have made the finals.

# *FEATURES*

## *Features*: Charlie Szoradi and LED Lighting

A few popular stories in energy - oil & gas pipelines, solar capacity, electric vehicles, Tesla's battery - too often overshadow other important topics. Perhaps the most important topic that receives the least amount of attention is "energy efficiency." The contrast is dramatic: Elon Musk's next space adventure is as entertaining as Light Emitting Diode (LED) lights is important. SpaceX may or may not create an interstellar tourism industry, but LED lights can cut electricity consumption in half! At $1/sq. ft. to retrofit a building with LED lights that have a life of ten years, the annual return on an investment is about $.33/sq. ft (which means the retrofit pays for itself in three years). The US DoD has enormous investment in technologies developed by Tesla, Amazon, and Microsoft, but virtually nothing in LED lighting, even though there is immediate opportunity (more than 2.8 million men and women in the US military work in more than 700,000 buildings at 5,000 different locations.) Indeed, virtually none of the US military's offices use LED lights ... taxpayers could save billions of dollars if they did.

**One of the leaders in energy efficiency efforts is Charlie Szoradi. Mr. Szoradi became CEO of Independence LED Lighting** in 2007, and moved the company's manufacturing facilities from China to Pennsylvania in 2010. Since then, LED Lighting has won a wide range of manufacturing, environmental, and workplace awards. Mr. Szoradi also just published a book, Learn By Looking, loaded with energy intelligence garnered from first hand observation and travel around the world, pausing along the way to sketch insights relevant to sustainable design. (No doubt influenced by his undergraduate work in architecture at Mr. Jefferson's university in Virginia.)

**The American Energy Society applauds LED Lighting in Pennsylvania** for embracing the less sexy side of energy, and admires Charlie Szoradi for his tireless contributions to energy, efficiency, manufacturing, workplace development, literature ... Mr. Jefferson would be proud.

## *What you may have missed:* Energy Matters, vol. 8(4)

- *Featured story*: Much like production of oil, gas and all renewables, **coal mining has implemented a series of new innovations that has improved production rates** in the US by 26%, reaching 6.8 tons per miner hour in 2017, up from 5.4 tons per miner hour in 2012.

# Energy Quotes

"The robust global economy pushed up energy demand last year, which was mostly met by fossil fuels, while renewables made impressive strides."
- Dr. Fatih Birol, IEA's Executive Director, summarizing the Global Energy and CO2 Status Report.

"It is not for us to declare ... 'mission accomplished', but if our outlook is accurate, it certainly looks very much like it."
- From the recent IEA Market Report, on the goal of OPEC to reduce oil production. (Production is down 800,000 bpd ... the equivalent amount that is produced by Saudi Arabia.)