

PART II -GLOBAL ENERGY DRIVERS

PPOLITICAL

EECONOMIC

SSOCIAL

TTECHNOLOGICAL

EENVIRONMENTAL

CCULTURAL


VVALUES



Environment

Huge Antarctic iceberg about to break off and slide into the sea

It isn't clear what damage the huge iceberg will do to the surrounding landscape

Andrew Griffin | @_andrew_griffin | Friday 6 January 2017 |  246 comments



7K
shares

 Like

Click to follow
The Independent

[http://
www.independent.co.
uk/environment/
antarctic-iceberg-
larsen-b-c-ice-shelf-
global-warming-
climate-change-
a7513786.html](http://www.independent.co.uk/environment/antarctic-iceberg-larsen-b-c-ice-shelf-global-warming-climate-change-a7513786.html)





<http://www.independent.co.uk/environment/>



CLIMATE CHANGE

GLOBAL WARMING (POLAR ICE CAP MELT,
SEA LEVEL RISE, SPREAD OF PESTS/
DISEASES UN-PRECEDENTED WEATHER
EVENTS (DISASTERS,FLOODS, HEAVY RAINS,
DROUGHT,)



https://www.allianz.com/en/about_us/open-knowledge/topics/demography/articles/110711-world-population-growth-are-we-too-many.html/



POPULATION GROWTH

PEOPLE ARE HEALTHIER & LIVING LONGER
WE ARE 10 BILLION IN THE 2050 (McKinsey 2017)!

Russia may be running out of oil

Published time: 9 Mar, 2016 09:50

[Get short URL](#)

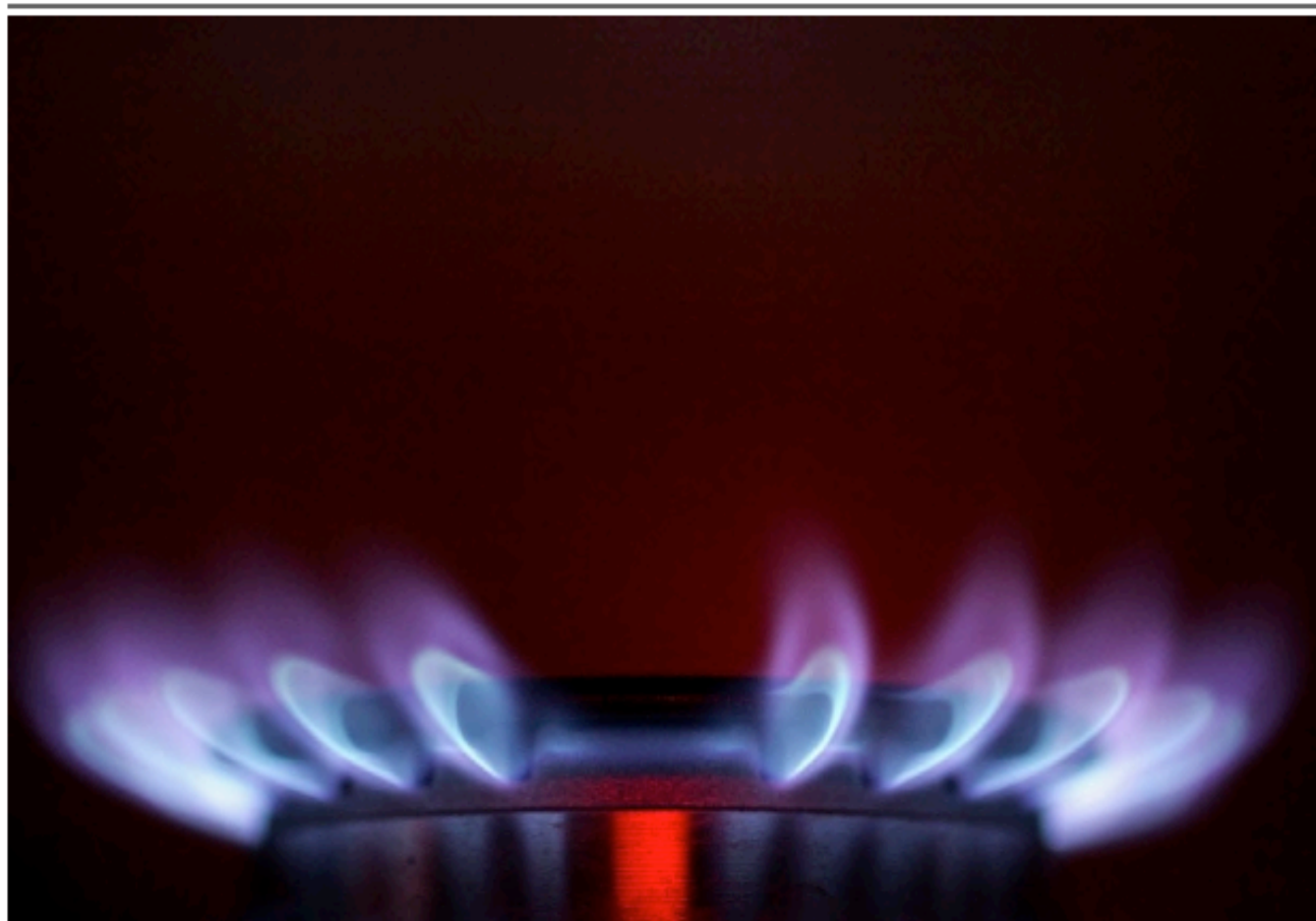


© Sergei Karpukhin / Reuters

<https://www.rt.com/business/334970-russia-oil-reserves-depletion-2035/>

The Earth is not running out of oil and gas, BP says

Global reserves could almost double by 2050 despite booming consumption, oil major says



The world is expected to reduce its reliance on fossil fuels in favour of cleaner sources of energy Photo: Getty



FINLAND FUTURES
RESEARCH CENTRE



RESOURCE SCARCITY

DEPLETING FOSSIL FUEL RESERVES,
DEPENDENCE ON TRADITIONAL
BIOMASS

Carbon capture and storage (CCS)

CO2 turned into stone in Iceland in climate change breakthrough

Radical new technique promises a cheaper and more secure method of burying CO2 emissions underground instead of storing it as a gas



🕒 This article is 8 months old

🔗 12,408 | 💬 1,033

Damian Carrington

🐦 @dpcarrington

Thursday 9 June 2016 19.00 BST



<https://www.theguardian.com/environment/2016/jun/09/co2-turned-into-stone-in-iceland-in-climate-change-breakthrough>



FINLAND FUTURES
RESEARCH CENTRE



Tesla's Battery Revolution Just Reached Critical Mass

Three new plants in California show how lithium-ion storage is ready to power the grid.

by **Tom Randall**

30 Jan 2017 13:45:21 GMT+2

<https://www.bloomberg.com/news/articles/2017-01-30/tesla-s-battery-revolution-just-reached-critical-mass>

Tesla Motors Inc. is making a huge bet that millions of small batteries can be strung together to help kick fossil fuels off the grid. The idea is a powerful one—one that's been used to help justify the company's \$5 billion factory near Reno, Nev.—but batteries have so far only appeared in a handful of true, grid-scale pilot projects.

T(E)

DECARBONISATION

TECHNOLOGY IMPROVEMENTS,
ENERGY EFFICIENCY,



Solar power
Global warning

China builds world's biggest solar farm in journey to become green superpower

Vast plant in Qinghai province is part of China's determination to transform itself from climate change villain to a green energy colossus



Tom Phillips in Gonghe county, Qinghai province

Thursday 19 January 2017 12.00 GMT



8,599 2

<https://www.theguardian.com/environment/2017/jan/19/china-builds-worlds-biggest-solar-farm-in-journey-to-become-green-superpower>



Longyangxia Dam Solar Park – the 850MW plant has the capacity to power up to 200,000 households.
Photograph: Tom Phillips for the Guardian



Solar Employs More Workers Than Coal, Oil and Natural Gas Combined

<http://www.ecowatch.com/solar-job-growth-2197574131.html>

(Jan 17, 2017)



Pump jacks are seen on the Bakken Shale Formation, near Williston, North Dakota, September 6, 2016. Photograph by Robyn Beck—AFP/Getty Images

U.S. SHALE OIL

U.S. Shale Firms Go Back to Work After Donald Trump's Victory

Reuters

Nov 14, 2016



U.S. shale producers are redeploying cash, rigs and workers, cautiously confident the energy sector has turned a corner after Donald Trump's election victory and OPEC's recent signal that it plans to curb production.

The downturn produced a leaner, more efficient U.S. shale industry that was forced to develop and quickly adapt new technology to compete with

<http://fortune.com/2016/11/14/donald-trump-victory-us-shale-oil/>

E

ECONOMIC GROWTH

GDP GROWTH PER CAPITA DOUBLE BY 2050
(McKinsey, 2016) - TRANSITION OF ECONOMY
TOWARDS SERVICE SECTOR? , INCREASED
STANDARD OF LIVING AND ENERGY
CONSUMPTION

Photo of the week: Beijing skyscrapers just peek out over airpocalypse

BY ALEX LINDER IN NEWS ON JAN 7, 2017 3:30 AM



http://shanghaiist.com/2017/01/07/beijing_above_airpocalypse.php



FINLAND FUTURES
RESEARCH CENTRE

Bangkok post
6 Jan 2017



Chinese people wearing protection masks perform social dances at a park blanketed by severe smog in Fuyang in central China's Anhui province on Jan 3, 2017. China's environmental ministry said Tuesday an unspecified number of companies had violated measures meant to reduce smog during a period of particularly noxious pollution in the country. AP

China: Some factories violated anti-smog measures

BEIJING: China's environmental ministry said Tuesday an unspecified number of companies had violated measures meant to reduce smog during a period of particularly noxious pollution in the country.

The Ministry of Environmental Protection said 10 inspection teams found companies resuming production despite a government ban and not complying with emission reduction measures.

The announcement came as 24 cities were under a pollution "red alert", the

highest warning level in China's four-tiered system. When authorities issue red alerts, some manufacturing companies are required to cut production and heavily polluting vehicles are banned from the roads.

The official Xinhua News Agency said the ministry had given out punishments after finding that more than 500 construction sites and enterprises, including metallurgy, agricultural chemical and steel plants, and 10,000 vehicles had breached pollution response plans. Xinhua gave no

details on the punishments.

Beijing has been on "orange alert" — the second-highest alert level — since Friday. The alert was originally due to end on Sunday, but authorities extended it for three days as the smog persisted.

Residents in the capital said the grey air left them feeling depressed.

"I have a child, but I can only keep him at home and he can't even go out for sunshine, which really worries me," said salesman Zhan Yan.

"The smog has a big negative impact on people's emotions," said another man, Gao Yan, who works for a consulting company. "We really hope we can live with a blue sky and be healthy."

China has long faced some of the worst air pollution in the world, blamed on its reliance of coal for energy and factory production, as well as a surplus of older, less efficient cars on its roads. Inadequate controls on industry and lax enforcement of standards have worsened pollution. AP



POLLUTION

CHINA AIR POLLUTION, NUCLEAR WASTE,
WATER AND SOIL POLLUTION (OIL SPILLS
ETC. EXXON), INCREASING HEALTH
PROBLEMS

Solar now cheaper than coal in some parts

JESSICA SHANKLEMAN
CHRISTOPHER MARTIN

LONDON/NEW YORK: Solar power is now cheaper than coal in some parts of the world. In less than a decade, it's likely to be the lowest-cost option almost everywhere.

In 2016, countries from Chile to the United Arab Emirates broke records with deals to generate electricity from sunshine for less than three cents a kilowatt-hour, half the average global cost of coal power. Now, Saudi Arabia, Jordan and Mexico are planning auctions and tenders for this year, aiming to drop prices even further. Taking advantage: companies such as Italy's Enel SpA and Dublin's Mainstream Renewable Power, who gained experience in Europe and now seek new markets abroad as subsidies dry up at home.

Since 2009, solar prices are down 62%, with every part of the supply chain trimming costs. That's helped cut risk premiums on bank loans, and pushed manufacturing capacity to record levels. By 2025, solar may be cheaper than using coal on average globally, according to Bloomberg New Energy Finance.

"These are game-changing numbers, and it's becoming normal in more and more markets," said Adnan Amin, International Renewable Energy Agency's director-general, an Abu Dhabi-based intergovernmental group. "Every time you double capacity, you reduce the price by 20%."

Better technology has been key in boosting the industry, from the use of

diamond-wire saws that more efficiently cut wafers to better cells that provide more spark from the same amount of sun. It's also driven by economies of scale and manufacturing experience since the solar boom started more than a decade ago, giving the industry an increasing edge in the competition with fossil fuels.

The average one megawatt-plus ground-mounted solar system will cost 73 cents a watt by 2025 compared with \$1.14 now, a 36% drop, said Jenny Chase, head of solar analysis for New Energy Finance.

That's in step with other forecasts.

GTM Research expects some parts of the US Southwest approaching \$1 a watt today, and may drop as low as 75 cents in 2021, according to its analyst MJ Shiao.

The US Energy Department's National Renewable Energy Lab expects costs of about \$1.20 a watt now declining to \$1

by 2020. By 2030, current technology will squeeze out most potential savings, said Donald Chung, a senior project leader.

The International Energy Agency expects utility-scale generation costs to fall by another 25% on average in the next five years.

The International Renewable Energy Agency anticipates a further drop of 43%-65% for solar costs by 2025. That would bring to 84% the cumulative decline since 2009.

The solar supply chain is experiencing "a Wal-Mart effect" from higher volumes and lower margins, said Sami Khoreibi, founder and chief executive of Enviromena Power Systems, an Abu Dhabi-based developer.

The speed at which the price of solar will drop below coal varies in each country. Places that import coal or tax polluters with a carbon price, such as Europe and

Bangkok Post
6 Jan 2017



This Aug 27, 2015, file photo shows a solar power array that is part of sustainability improvements at the Lamar Buffalo Ranch in Yellowstone National Park, Wyoming. In recent years, huge solar and wind farms have sprouted up on public desert land in the Western US. AP

Brazil, will see a crossover in the 2020s, if not before. Countries with large domestic coal reserves such as India and China will probably take longer.

China, the biggest solar market, will see costs falling below coal by 2030, said New Energy Finance. The country has surpassed Germany as the nation with the most installed solar capacity as the government seeks to increase use to cut carbon emissions and boost home consumption of clean energy. Yet curtailment remains a problem, particularly in sunnier parts of the country as congestion on the grid forces some solar plants to switch off.

Sunbelt countries are leading the way in cutting costs, though there's more to it than just the weather. The use of auctions to award power-purchase contracts is forcing energy companies to compete with each other to lower costs. BLOOMBERG

in ANZ's 20
"The sa
plify our b
efficiency,
Graham F
would allo
on its Asian
will increa
about 40 b
. ANZ sh
outperform
200 financ
gained 8.9
"It is a st
for ANZ," T
ing analyst
phone, not
the risk of
For Cos
is another

GDP

Sing

SINGAPORE
economy g
est pace si
in 2009, af
sion in the
showed Tu
Analysts
even be mo
ism crimps
US interest
local econo
"Singap
technical r
but we exp
in 'slow-m
Asia econo
"The pr
trade polic
pore's econ
the old exp
There ha
export-driv
tectionism
tion and fre
for sending

Solar Power Is Now The World's Cheapest Energy

The drop in price is driven by investments from developing nations.



By Sophie Weiner Dec 16, 2016

8.8k



Over the past six years, the cost of solar energy has dropped dramatically, to the point where it is now even cheaper than wind power in emerging markets like China and India. This may be largely due to rising investments in solar over the last few years. Now, there is electricity being produced in Chile for \$29.10 per megawatt hour—half the price of power produced by coal.

[http://
www.popular
mechanics.co
m/science/
green-tech/
a24357/solar-
power-
cheapest-
energy/](http://www.popularmechanics.com/science/green-tech/a24357/solar-power-cheapest-energy/)





A report on wind technology from a few weeks ago said: "Lower **wind** turbine prices and installed project costs, along with improvements in expected [production capacity], are enabling aggressive wind power pricing" The report shows that prices dropped from nearly 7 cents/kWh in 2009 to 2.35 cents/kWh in 2014, which is pretty incredible (it's not that low everywhere, but over time it should keep going down). The report says the cost

Low fossil fuel prices hindering climate change fight, says IMF

International Monetary Fund suggests prolonged period of low oil, coal and gas prices could discourage further adoption of cleaner energy sources



🕒 This article is 1 year old



Larry Elliott

Thursday 3 December 2015 12.37 GMT

[https://
www.theguardian.com/
business/2015/dec/03/
low-fossil-fuel-prices-
oil-climate-change-
fight-imf](https://www.theguardian.com/business/2015/dec/03/low-fossil-fuel-prices-oil-climate-change-fight-imf)



Oil prices have fallen by more than 60% in the past 18 months. Photograph: Karen Bleier/AFP/Getty

The International Monetary Fund has issued a warning before a meeting of the Opec oil cartel that permanently low fossil fuels are choking off investment in renewable sources of energy and hindering the fight against climate change.

E

PRICE

TECHNOLOGY IMPROVEMENTS,
ECONOMIES OF SCALE, INCREASED
PRICE OF FOSSIL FUELS



<http://www.towardfreedom.com/32-archives/environment/4424-standing-strong-as-a-rock-resistance-to-dakota-access-pipeline-continues>

**COP 21: UN climate
change conference |
Paris**

Paris climate change agreement: the world's greatest diplomatic success

With all 196 nations having a say, the UN climate deal, with all its frustrations and drama, has proven that compromise works for the planet



12,546

66

Fiona Harvey in Paris

Monday 14 December 2015 07.51 GMT

[https://
www.theguardian.com/
environment/2015/dec/
13/paris-climate-deal-
cop-diplomacy-
developing-united-
nations](https://www.theguardian.com/environment/2015/dec/13/paris-climate-deal-cop-diplomacy-developing-united-nations)



French foreign minister and president-designate of COP21 Laurent Fabius (centre), raises hands with UN secretary general Ban Ki Moon and French president François Hollande. Photograph: Francois Guillot/AFP/Getty Images

POLITICS | Wed Jan 25, 2017 | 12:31pm EST

Trump administration tells EPA to cut climate page from website: sources



Children play amid Icebergs on the beach in Nuuk, Greenland, June 5, 2016. REUTERS/Allister Doyle

POLITICS

ACCEPTANCE, COMMITMENT, POWER
BALANCES, FOREIGN TRADE,
INTERNATIONAL AGREEMENTS

Renewable/Other Energy

Wind turbines “causing bats’ lungs to explode”

f

t

G+

in

✉

<https://www.energyvoice.com/otherenergy/120314/wind-turbines-causing-bats-lungs-explode/>



Renewables news

Written by **Mark Lammey** - 27/09/2016 5:22 am

Wind turbines may trigger danger response in brain

The low frequency noises from turbine blades can be picked up and can trigger a part of the brain linked to emotions, scientists have found



1K



0



2



1K



Email



<http://www.telegraph.co.uk/news/science/science-news/11736728/Wind-turbines-may-trigger-danger-response-in-brain.html>

Even 'inaudible' wind farms may be producing sounds which can be picked up by humans, scientists have claimed Photo: PA

Environment

Wind power now UK's cheapest source of electricity – but the Government continues to resist onshore turbines

New figures show they not only produce cheaper energy than coal, oil or gas power stations, but also remain far cheaper than offshore turbines

Tom Bawden Environment Editor | @BawdenTom | Wednesday 7 October 2015 |  75 comments



Click to follow
The Independent Online



<http://www.independent.co.uk/environment/wind-power-now-the-cheapest-source-of-electricity-but-the-government-continues-to-resist-onshore-a6685326.html>



FINLAND FUTURES
RESEARCH CENTRE

Germany: Nuclear power plants to close by 2022

🕒 30 May 2011 | Europe | 📄

🔗 Share



Germany saw mass anti-nuclear protests in the wake of the Fukushima disaster

Germany's coalition government has announced a reversal of policy that will see all the country's nuclear power plants phased out by 2022.

<http://www.bbc.com/news/world-europe-13592208>



FINLAND FUTURES
RESEARCH CENTRE

Guardian sustainable
business

From open defecation to toilets that produce biogas and fertiliser

New innovations in compost toilets aim to make a dent in sanitation and energy problems in the developing world



52 | 8

Oliver Balch

@OLIVERBALCH

Wednesday 14 May 2014 13.17 BST

[https://
www.theguardian.com/
sustainable-business/
india-compost-toilets-
biogas-fertiliser-defecation](https://www.theguardian.com/sustainable-business/india-compost-toilets-biogas-fertiliser-defecation)



A Sulabh toilet complex in Kabul, Afghanistan, which produces biogas that can be used for lighting, cooking and generating electricity. Photograph: Sulabh

The Hindu temples of Pashupatinath and Guheshwori in Kathmandu attract hundreds of thousands of visitors every year. Many come to the sacred

PERCEPTION

IMAGE, ACCEPTABILITY, ATTITUDES, COMMITMENT

END OF PART II
QUESTIONS?
COMMENTS?