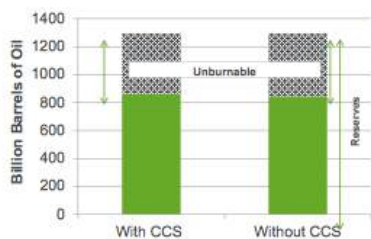




“We appear to have moved into a new era of energy now”

August 27, 2015. [Kuwait cree que el precio de las renovables caerá más que el del petróleo.](#) Dan McCue, Energías renovables. “El precio del petróleo lleva unos meses bajo mínimos (el barril de Brent está hoy en 45 dólares). Pero un informe demuestra que **uno de los principales productores de crudo del mundo como Kuwait tiene sus ojos puestos en las renovables.** Kuwait cree que el precio de las renovables caerá más que el del petróleo. Kuwait ha recibido con los brazos abiertos la disminución de costes de las renovables (...) “El uso de energías alternativas en Kuwait es importante por tres razones”, explica Bader Al Taweel, presidente de Energía Renovable en Sociedad de Ingenieros de Kuwait. “La creciente demanda de electricidad, el alto precio del petróleo, y el ambiente óptimo para la inversión en energías alternativas, como el sol y el viento que abundan en Kuwait”. Los hidrocarburos son el centro de de la economía de Kuwait, ya que representan más del 90% del PIB del Estado y el 80% de los ingresos del gobierno. La demanda de petróleo para la exportación y para consumo interno sigue aumentando, lo que significa que su producción seguirá considerándose crítica para el gobierno en los próximos años. Pero Kuwait no es ajeno al creciente tirón global de las renovables”

Figure 91. Total and Unburnable Oil Reserves



Source: McGlade et al. (2015), Citi Research

Figure 92. Total and Unburnable Gas Reserves



Source: McGlade et al. (2015), Citi Research

Figure 93. Total and Unburnable Coal Reserves

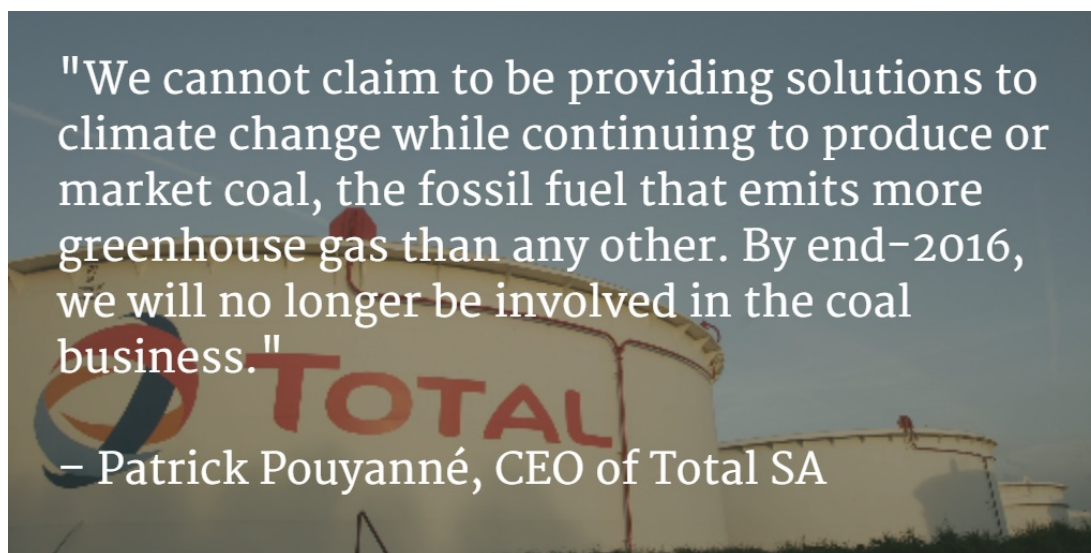


Source: McGlade et al. (2015), Citi Research

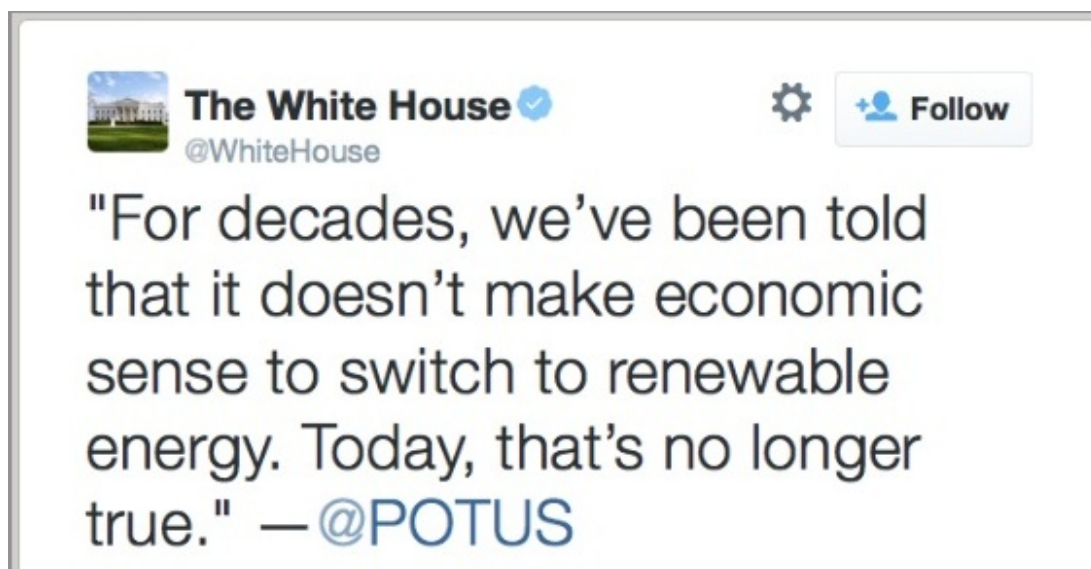
August 25, 2015. [Citigroup sees \\$100 trillion of stranded assets if Paris succeeds](#) by Giles Parkinson, RenewEconomy. “If you hear a lot of noise about climate policies and climate action over the next few months in the lead up to the Paris climate conference, it is because there is a lot at stake. According to Citigroup analysts: \$US100 trillion of potential stranded assets in the fossil fuel industry. A new Citigroup report values the fossil fuel reserves that need to be left in the ground if the world is to meet its targets of trying to limit global warming to 2°C – a target that, [according to a new Climate Council report](#), is actually a lot less “safe” for humankind than the science thought it was just 10 years ago. Nevertheless, that is the stated target of all governments – including Australia’s – and Paris will endeavour to put in place a mechanism that will allow the world to meet that goal. But if the world is serious about meeting this target, it needs to respect its “carbon budget” – and that calls for **one-third of global oil reserves, one half of global gas reserves, and 80 per cent of global coal reserves to remain in the ground.**”

August 25, 2015. [The Eurasian Big Bang: how China and Russia are carving out their own world order](#) by Pepe Escobar, energypost. While politicians in the United States are outdoing each other condemning the Iran nuclear agreement, the rest of the world is moving on, writes Asia Times correspondent Pepe Escobar. Virtually unreported by western media, **China, Russia, India, Iran and other nations are establishing financial, economic, political and energy infrastructure partnerships that are changing global relations irrevocably.** The EU meanwhile is mostly ignored.

August 25, 2015. **Total divestment: French energy giant ditches coal** by Helle Abelvik-Lawson, EnergyDesk. “It’s not been a great year for the world’s coal giants. We’re hearing that China is using less coal and the value of their shares has plummeted. Now one of the world’s biggest energy companies has given up on producing coal altogether. **Total SA, the French oil company and one of the six “Supermajor” fossil fuels companies, [has confirmed](#) it is no longer producing coal** (...) Total is still a fossil fuel company – though unlike its main rivals it does actually own [since 2011] a solar company too [[SunPower](#), the second-ranked global operator; but BP also owns [BP Solar](#), one of the world's largest solar companies]”



August 24, 2015. **[National Clean Energy Summit 8.0: Powering Progress. Obama during Clean Energy Summit...](#)**



August 21, 2015. **[The Power Revolutions](#)** by Daniel yergin, Wall Street Journal. “Natural gas, solar power and data-driven efficiency are making big gains, but history shows that **the shift away from coal and oil won’t be fast or neat.**”

August 19, 2015. **[Paris and the climate talks: business’ shortest route to success](#)** by Peter Bakker (World Business Council on Sustainable Development), Business Green. “An increasing number of businesses stepping up to tackle the climate challenge and lead governments in adopting ambitious

measures. **Decisions made at COP21 will influence the way we do business as well as the world we do it in** (...) Business has an important role to play in driving the transition to a low-carbon economy (...) **The past four months have seen an unprecedented mobilisation by business** (...) **This is an historic business opportunity and it is yours to seize. The transition to a low-carbon economy has already started. The successful businesses of tomorrow will be the ones taking the lead on climate today.**”

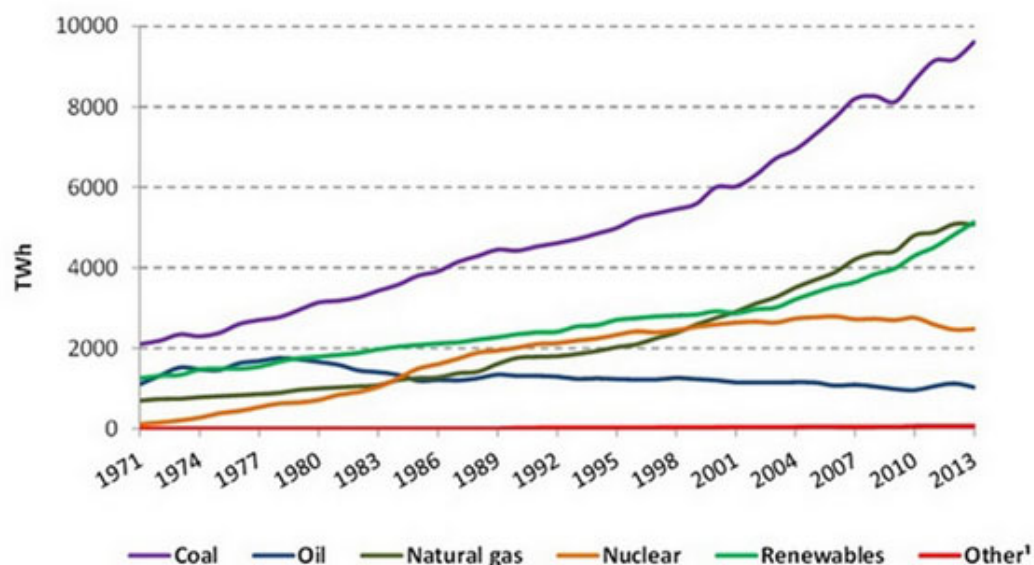
August 18, 2015. **Statement: Islamic Declaration on Climate Change. Calls For 1.6 billion Muslims to Support Strong Paris Agreement.** “We call upon corporations, finance, and the business sector to: Shoulder the consequences of their profit-making activities, and take a visibly more active role in reducing their carbon footprint and other forms of impact upon the natural environment; In order to mitigate the environmental impact of their activities, commit themselves to 100 % renewable energy and/or a zero emissions strategy as early as possible and shift investments into renewable energy; Change from the current business model which is based on an unsustainable escalating economy, and to **adopt a circular economy** that is wholly sustainable; Pay more heed to social and ecological responsibilities, particularly to the extent that they extract and utilize scarce resources; **Assist in the divestment from the fossil fuel driven economy and the scaling up of renewable energy and other ecological alternatives.**”

context=

August 18, 2015. **Islamic Climate Declaration calls for fossil fuel phase out.** “Islamic leaders from 20 countries today launched a bold Climate Change Declaration to engage the world’s 1.6 billion Muslims on the issue of our time. Adopted by the 60 participants at the International Islamic Climate Change Symposium, (Istanbul, 17-18 August) the Declaration urges governments to deliver a strong, new international climate agreement in Paris this December that signals **the end of the road for polluting fossil fuels** by creating architecture that will give us a chance of limiting global warming above pre-industrial levels to 2, or preferably 1.5, degrees Celsius. **The Declaration presents the moral case, based on Islamic teachings, for Muslims and people of all faiths worldwide to take urgent climate action.**”

August 14, 2015. **Renewable energy becomes second largest source of global electricity.** “Renewable electricity generation **outpaced natural gas this month to become the second largest source of electricity worldwide**, according to the International Energy Agency. **Globally, coal remained king** with 9,613TWh of electricity produced, around 41% of global electricity production compared to 5,130TWh (22%) from renewable energy sources”

World electricity production by source from 1973 to 2013



1. Includes non-renewable wastes, electricity from chemical heat and other sources (e.g. fuels cells)

August 13, 2015. [CalPERS, CalSTRS took big losses on energy investments, report says](#) by Dean Starkman, Los Angeles Times. “**California's two major public pension funds, the biggest in the nation, lost a total of more than \$5 billion on energy-related investments** for their fiscal years, ended June 30, according to a new report (...) Trillium produced the report on behalf of 350.org, an environmental group backing a pending state Assembly bill that calls for California's big pension funds to divest from coal-related holdings.”

August 12, 2015. [Climate Risk for Investors Becoming Clear](#) by [Cary Krosinsky](#), United Nations Environment Programme (UNEP) Advisor. “While many continue to discount calls for divestment and the value at risk from climate change, a growing body of work shows that **value has already been lost and much more is in the balance**. There are five main and considerable new categories of risk to consider: ...”

August 12, 2015. [Las grandes petroleras pierden 130.000 millones](#) por Gema Escribano y Alberto Roa, Cinco Días.

August 11, 2015. [China To Spend Trillions On 'Green Tech'](#) by Kenneth Rapoza, Forbes. “**The Chinese government will spend upwards up \$2.5 trillion over the next 15 years on clean energy** projects designed to provide a lift-off to its most promising alternative energy firms. Rae Kwon Chung, principal advisor on climate change of the United Nations Secretary-General, came up with the figures during the China Summit on Caring for Climate hosted by the U.N. Global Compact Network China. Chung said that **China pumped \$90 billion into the renewable energy sector in 2014, more than one quarter of the world's total investment in green technology.**”

August 9, 2015. [Saudi Arabia's economy heats up thanks to solar energy](#). “One of the biggest oil producers in the world is set to invest heavily in solar power, marking a turning point for a once troubled industry (...) Saudi Arabia's oil minister, Ali al-Naimi, told a business and climate conference in Paris that the days of our reliance on oil and gas appeared numbered. “**In Saudi Arabia, we recognise that, eventually, one of these days, we're not going to need fossil fuels**” (...) “If Saudi Arabia is starting to hedge its bets by developing solar capacity, **this could change the fundamentals of the oil market**” (...) According to the International Energy Agency, if countries agree to new climate change targets, **renewable energy could overtake oil and coal as the world's primary fuel within 15 years.**”

August 5, 2015. [Why Are Americans Switching to Renewable Energy? Because It's Actually Cheaper](#) by Tara Lohan, The Nation. “**Fossil fuels have become an economic liability—for both consumers and energy companies.**”

August 4, 2015. [G20 countries pay over \\$1,000 per citizen in fossil fuel subsidies](#), says IMF by Damian Carrington, The Guardian. “**World's leading economies still paying trillions in subsidies despite pledges to phase them out, new figures show.**”

August 3, 2015. [What the Clean Power Plan Means For America](#). **President Obama is announcing the finalization of America's Clean Power Plan, the biggest step we've ever taken to combat climate change.** This plan sets the first-ever carbon pollution standards for power plants, while providing states and utilities with the flexibility they need to meet those standards. Here's why this matters: Existing power plants are the largest single source of carbon pollution in the United States (...) The Clean Power Plan is a landmark action to protect public health, reduce energy bills for households and businesses, create American jobs, and bring clean power to communities across the country.”

Global Biogas: August's Overview

EUROPE. August 27, 2015. **Feed-in Tariff could be closed to new applicants by January 2016** by Brad Allen, edie.net. “The Feed-in Tariff (FIT) scheme, which offers subsidy support to small scale renewables, could be closed to new applicants by January 2016, the UK Government announced today.”

August 27, 2015. **UK: Government FIT consultation ‘disaster’ for AD growth** by Derek Sivyler, ADBA. “DECC has today published a consultation on its review of the Feed-in Tariff scheme. Despite the consultation leaving AD tariffs unchanged for now, **the proposal to limit the FITs scheme to a maximum overall budget of £75-100 million from January 2016 to 2018/19 will have a disastrous affect on investor certainty and therefore any further deployment.** DECC are proposing to support just 17 new AD plants in 2016. Commenting on the disturbing document, ADBA’s Chief Executive, Charlotte Morton, explained: “The FIT consultation proposes restricting support for anaerobic digestion to just 17 new plants next year – which would effectively mean an 80% cut in investment for an industry which deployed 89 clean baseload power plants in 2014.”

August 25, 2015. **UK: AD electrical capacity surges beyond 500MWe** by Derek Sivyler, ADBA. “The anaerobic digestion (AD) industry now delivers an electrical equivalent capacity (electricity and biomethane) of 514 megawatts across 411 plants in the farming, waste and water sectors. Commenting on this substantial progress, ADBA’s Chief Executive, Charlotte Morton, said: “Last month I announced a new industry milestone following the unveiling of the UK’s 400th biogas plant. ADBA’s market data now shows that AD offers over 500MWe electrical **equivalent capacity – more capacity than one of the UK’s nuclear power plants**, Wylfa, which is being decommissioned this year (...) To continue to expand the industry needs viable support in the forthcoming FIT review, and an RHI budget which will support new green gas. **AD has the potential to meet 30 per cent of UK domestic gas demand**, and overall it could cut UK greenhouse gas emissions by four per cent and support food security and production.”

August 19, 2015. **Contribution of anaerobic digestion to the European Circular Economy**, European Biogas Association (EBA). “Anaerobic digestion (AD) is an **important pillar of the European circular economy**: it mitigates GHG emissions, recycles nutrients in the form of organic fertilisers, prevents nitrogen leakage into groundwater and avoids the spread of harmful diseases through landfilling. Additionally, AD is a vital part of the European bio-economy tapping into leftovers of other industries and thereby improving European resource-efficiency. Through further scientific research and development, this kind of cascading use could be exploited even more (...) To summarise, EBA prompts EU policy-makers to: ...”

August 18, 2015. **France boosts biogas subsidies.** “The government has expanded support for the biogas sector, **going against the trend for many other countries where subsidies have been cut.** The French government has announced plans to increase subsidies for biogas plants by between 10% and 20% (...) **The government’s support for the biogas sector follows the recent adoption by French Members of the Parliament of the Energy Transition for Green Growth.** This law aims to cut France’s greenhouse gas emissions by 40% between 1990 and 2030 and divide them by four by 2050, to halve the country’s energy usage by 2050, to reduce the share of fossil fuels in energy production, to cap the total output from nuclear power at 63.2 GW (77% out of the total) and bring the share of renewables up to 32% of the energy mix.”

context=

August 17, 2015. **La loi transition énergétique est officiellement promulguée. LOI n° 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte**

August 13, 2015. **Le Conseil constitutionnel valide la loi sur la transition énergétique.**

August 10, 2015. Germany: **The rebellion of the biogas farmers** by Jost Maurin, TAZ. “Until 2014, running a biogas plant in Germany was a profitable and secure business. Power from biogas was paid for by feed-in tariffs, set for 20 years in the Renewable Energy Act (EEG). Crops like maize for biogas production covered 11 percent of Germany’s arable land in 2014. **But since the rules in the EEG changed in August 2014, many biogas farmers are “feeling pushed into a corner,”** one of them told Maurin. The reform has reduced feed-in tariffs so much, that hardly any new plants have been built. The existing operations have seen their guaranteed income cut – with retroactive effect – the farmers say and have launched a complaint with the German Constitutional Court. Meanwhile environmental activists fight the monocultures of biogas farmers and say that the land should instead be used for ecologic farming.”

August 5, 2015. **La fin des tarifs d’achat pour le biogaz en Allemagne** par Thibaut Chapron, consultant OFAEnR (French German office for renewable energies). “Avec une puissance installée totale dépassant les 4 000 MW, **les 8 000 méthaniseurs allemands jouent un rôle essentiel dans la production d’électricité et de chaleur du pays.** Les énergies renouvelables représentaient en 2014 une part de 26,2% de la production d’électricité allemande. **Environ 55% de cette production renouvelable est intermittente, ce qui représente un défi majeur pour les gestionnaires de réseau et la stabilité du système électrique.** Afin d’inciter les producteurs d’électricité renouvelable à adapter leur production à la courbe de demande, le législateur allemand a introduit dès 2012 la possibilité pour les producteurs de vendre leur électricité renouvelable directement sur le marché dans le cadre d’un système de primes de marché en opposition au tarif d’achat classique. La prime de marché représente la différence entre une valeur de référence – définie par le législateur – et le prix moyen de l’électricité sur le marché. Le producteur est ainsi incité à produire et vendre son électricité sur le marché quand les prix en bourse sont les plus élevés. Le modèle mis en place incite ainsi l’exploitant d’un méthaniseur à produire quand le système en a le plus besoin. En adaptant sa production aux besoins du système, l’exploitant peut ainsi maximiser le revenu issu de la vente de son électricité. De 2012 à 2014, les producteurs avaient le choix de vendre leur électricité sur le marché ou avec le tarif d’achat en basculant au besoin d’un modèle à l’autre, et ce de manière mensuelle. Depuis 2014, la vente directe est obligatoire pour les installations d’une puissance de plus de 500 kW (100 kW à partir de 2016) et les valeurs de référence, utilisées pour le calcul de la prime, ont été revues à la baisse. Pour les installations de plus de 100 kW, seule la production de la moitié de la puissance installée est dorénavant éligible au soutien financier. Les petites installations ont quant à elles toujours le choix entre tarifs d’achat et prime de marché. (...) **La nouvelle loi incite à la construction d’installations de méthanisation plus flexibles qui s’intègrent mieux dans le marché.**”

UNITED STATES. August 11, 2015. **Garbage to Gas** by Anne Kim, Republic 3.0, Washington Monthly. “According to the Environmental Protection Agency (EPA), landfills are among the nation’s largest sources of methane, accounting for nearly one-fifth of all methane emissions generated by human activity in 2012. That’s why advocates of landfill gas projects say these efforts have enormous environmental benefits - first, by capturing harmful methane emissions that would otherwise contribute to climate change and second, by replacing more carbon-heavy fuels for power and transportation. Moreover, there’s no shortage of garbage. Americans dump about 250 million tons of municipal solid waste per year -including 70 million tons of food and yard waste. It’s a clean energy opportunity the nation is literally throwing away. **Advances in waste management, along with recent changes in federal and state policy, are now prompting a potential boom in bio-methane opportunities** (...) But for this to happen, policymakers need to stop overlooking biomethane in favor of what seem to be more glamorous alternatives. “We put a lot of our investment dollars and policy focus on wind and solar,” says Johannes Escudero, Executive Director of the industry-led [Coalition for Renewable Natural Gas](#). “But if we were to cap every landfill today, we’re talking about methane emissions for another 30 to 100 years. We need to incentivize development projects that capture those gases and put them to good use, whether it’s electricity, heating, or transportation fuel.”

BRICS (Brazil Russia India China South Africa). August 27, 2015. [AB con la cogenerazione da biogas da discarica diventa leader del settore in Brasile](#). Inaugurato il primo dei due grandi siti di cogenerazione alimentati da biogas da discarica voluti dal Governo locale e da Solvi, società leader in Brasile el trattamento ecologico dei rifiuti, di cui AB è partner. Situato a Minas do Leão (Rio Grande do Sul) l'impianto, inaugurato alla presenza delle Istituzioni locali, sfrutta soprattutto i rifiuti domestici della città di Porto Alegre, per un quantitativo di oltre 3.500 tonnellate quotidiane e a pieno regime genera 8,5 MegaWatt di energia elettrica **servendo i fabbisogni energetici di oltre 200.000 persone** (...) «A seguito di questa prima realizzazione stiamo già sviluppando la più importante commessa mai ricevuta da AB nel settore “Landfill” afferma Angelo Baronchelli, Presidente di AB. **“A breve verrà infatti completato il secondo e più grande sito di produzione cogenerativa da gas da discarica al mondo: ben 21 Ecomax® 14BIO (circa 30 MW) a Caieiras, nella regione di São Paulo.”**»

August 21, 2015. **Low Emission Farm in China**. [Sustainable livestock production: Low Emission Farm – the innovative combination of nutrient, emission and waste management with special emphasis on Chinese pig production](#). “Global livestock production is going to be more and more sophisticated in order to improve efficiency needed to supply the rising demand for animal protein of a growing, more urban and affluent population. To cope with the rising public importance of sustainability is a big challenge for all animal farmers and more industrialized operations especially.”

August 17, 2015. [Uruguai replica projeto brasileiro de biogás](#). “Um condomínio composto por 33 pequenos produtores rurais que geram energia por meio de dejetos de animais e resíduos agrícolas e que juntos são capazes de abastecer cerca de 42 casas brasileiras, com uma média de três moradores. O projeto – conhecido como [Ajuricaba](#) - que deu certo em Marechal Rondon, no Oeste do Paraná, agora está sendo replicado no sul do Uruguai (...) Em cada propriedade, dejetos da produção agropecuária (gado) são transferidos para biodigestores, para produção de biogás. Os biodigestores estarão conectados à uma microcentral por meio de um gasoduto de 37 quilômetros de extensão. Já a matéria orgânica residual do biodigestor pode ser transformada em biofertilizantes. Além de gerar energia, o biogás produzido nas propriedades pode ser usado internamente, como, por exemplo, para cozinhar ou aquecer a água que higieniza o sistema de ordenha. **A proposta de gerar energia com biogás em condomínios, em que biodigestores são conectados por um gasoduto a uma só central geradora, é genuinamente brasileira. Na Europa, são feitos grandes biodigestores, para os quais são transportados dejetos.**”

August 10, 2015. Russia: [Luzhkov suggested to turn sanctioned products into biogas](#). “Last week, Russia began to destroy products prohibited (...) In the first two days it had been destroyed 350 tonnes of illegal products (...) Sanctioned products which were in Russia illegally and should be destroyed, it would be possible to produce quality fertilizer, biogas, and even electricity. Luzhkov told the publication that the installation, allowing the processing of organic fertilizer getting, gas and electricity, is already in the Belgorod and Kaluga regions. One of them, in particular, processes in biogas meat wastes, silage corn and chicken droppings. “Any organic material can be processed into electricity” said former Moscow Mayor Yuri Luzhkov (...) The decree on **the destruction of products from countries that have imposed sanctions against Russia**, was signed by Vladimir Putin in late July and entered into force on 6 August. It deals with production from the US, EU, Canada, Australia and Norway, the import of which was banned in Russia until August 5, 2016.”

On the Role of Biogas among Renewables

August 28, 2015. **Germany could rethink role of biomass plants - experts** by Laura Raus, ICIS. “As Germany’s prepares to revise its renewable energy law again, experts say the country should review the role of biomass – **a carbon-neutral way of balancing fluctuating wind and solar electricity generation** (...) The German energy agency dena, which helps the government form its energy policies, said it is still working on its position about the role of biomass in the future power market. The ministry is likely to decide the future of biomass subsidies after 1 October. This is when a public consultation on financing new wind and solar plants through tenders closes. Biomass was out of the scope of this consultation, but the tender model could be re-used for the fuel if the government rethinks its role in the energy sector. Consultancy PwC points out in a discussion paper that **even though the government estimates biomass to be more expensive than wind or solar power, it has the advantage of being able to adjust to demand** (...)

August 19, 2015. **Biogas - Equipped for the future** PresseBox, Berlin/ Kassel. “**New economic opportunities through flexibility of existing biogas plants.** On the basis of new knowledge and product developments show experts and specialized service attractive, yet largely underestimated earnings potential of the flexible schedule operations. **The interaction between the weather-dependent electricity generation from wind and solar in one hand, and controllable production of bioenergy on the other hand is becoming increasingly important.** This creates new challenges for plant operation and power marketing - and attractive new revenue opportunities for the plant operator, CHP manufacturers and service providers with specialized expertise. **The conventional operation of plants will be replaced in future by a flexible procedure for electricity market dependent timetables** (...) The [conference](#) [side-event of “Kongress 100% Erneuerbare-Energie-Regionen”, next November 9 in Kassel] is aimed at operators of existing biogas plants, representatives from local politics and administration, planners, energy consultants, equipment manufacturers and corporate customer relationship managers of banks. Programme and registration: <http://www.kwkkommt.de>”



August 16, 2015. [Regional Energiewende: Rosenheim farmers deliver biogas electricity for Rosenheim Oktoberfest](#). **New power supply concept for their Oktoberfest; virtual power plant with 21 local biogas producers.**

July, 2015. **Evaluating cost-effective greenhouse gas abatement by small-scale anaerobic digestion** by Eduardo Mesa-Dominguez (Bangor University), David Styles (Bangor University), Kiara Zennaro (Renewable Energy Association) and Paul Thompson (Renewable Energy Association); funded by the BBSRC AD Network. “This project focuses on the benefits of small

scale AD largely based on manures/slurries, with particular focus on its GHG emission abatement potential and its cost effectiveness in abating CO₂e emissions when compared with other options (...) Small scale, farm AD largely based on manures/slurries is typically less cost-effective in cost per kWh generated than larger scale electricity generation. However, as confirmed by the results shown in this report, **since it has the potential to abate substantial amounts of GHG emissions it is much cheaper when looking at it in terms of carbon savings.** Results show that each tonne of dry matter of cattle slurry avoids 1449 kg CO₂e, and generates 443 kWh of electricity, leading to a GHG abatement cost of £60 per tonne of CO₂e saved at a FIT rate of £0.20 per kWh. This compares very favourably with £ 182 per tonne of CO₂e, which is the cost estimated for other renewable electricity generation based on a subsidy level of £0.09 per kWh (previously taken by Government as the maximum level it should pay for renewable energy). Thus, we conclude that even at a FIT rate of £0.20 per kWh, small scale farm AD largely based on manures/slurries would represent very cost-effective GHG abatement.”

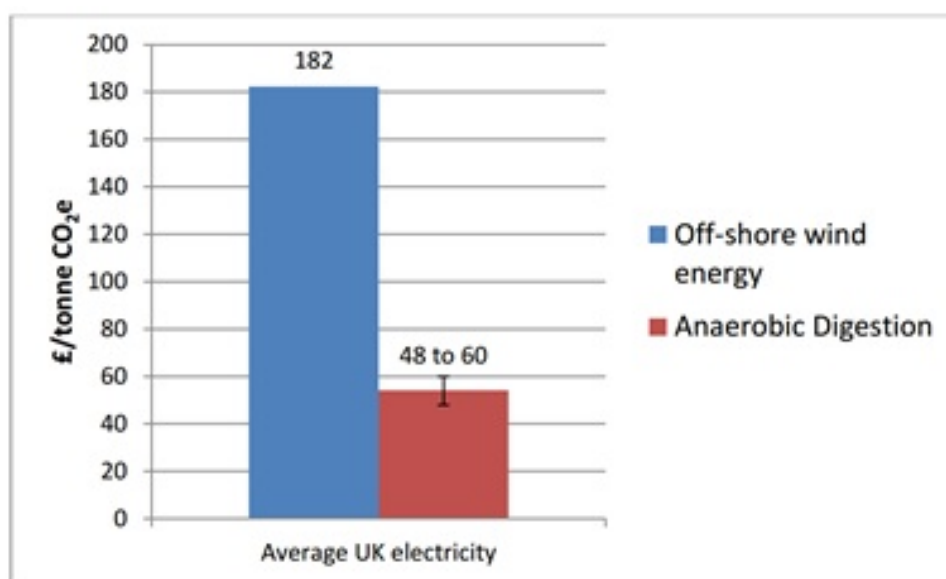
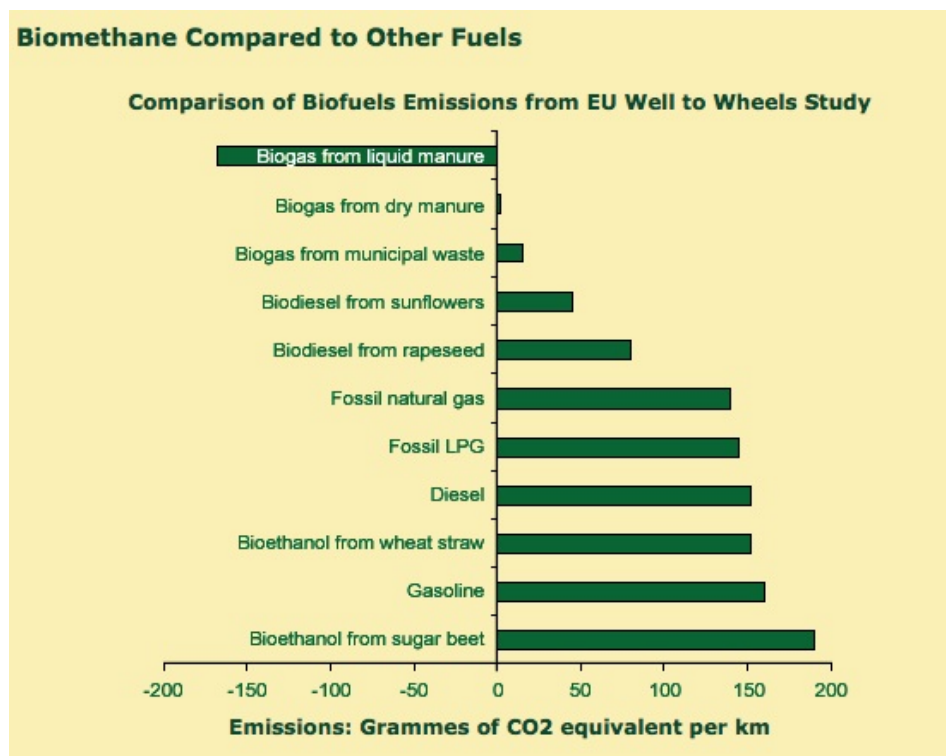


Figure 2. Comparison of abatement costs for off shore wind renewable energy and AD based on replacement of grid average electricity generation. The Error bars show the range of values for lower and higher FIT rates (0.16 and 0.20 £/kWh, respectively).

Small-scale anaerobic digestion costs 70% less per tonne CO₂ than offshore wind

July 29, 2015. **Here's why Electric Vehicles are not greener OR why BioCNG will always be as green!** by Brad Couch. “EV's at best are equal to BioCNG powered vehicles and that is assuming BEST CASE scenario for EV's. In today's world, best case simply doesn't apply most of the time. In other words, BioCNG powered vehicles soundly beat EV environmental performance most of the time! (...) **Environmentally, producing energy from waste will always out-produce energy made from virgin feedstock or renewable energy that requires toxic infrastructure/equipment or energy intensive equipment (like huge wind turbines, “rare earth” components, toxic batteries, etc).** Consider this, a car is a car is a car, so when considering environmental impact the car is a zero in the comparison equation. Wrong! Natural gas vehicles have much smaller batteries. That alone is a huge difference when one considers sourcing of materials, manufacturing and disposal (let alone fire safety – toxic burning). **BioCNG vehicles are fueled typically at the source of the biogas production which means much less energy loss from transmission (as in electrical grid transmission loss or fugitive emissions).** And by producing waste from energy, the

waste stream is turned into usable by products as well, preserving landfill space (which by the way, is a lousy way to deal with waste) and creating sellable commodities such as heat, electricity and soil amendments IN ADDITION to BioCNG for fueling stations.”



From *Well-to-Wheels* analysis of future automotive fuels and powertrains in the European context

June 15, 2015. **Biogas – a way of storing renewable electricity?** by Nikoletta Giantsiou, ATBEST researcher at University Duisburg-Essen. “Many of the technological barriers to producing renewable electricity have now been overcome, with methods to harness wind, solar and tidal power now established, but storage methods are required in order to improve the utilisation of this energy (...) The low energy density of biogas renders biogas an inefficient energy carrier for long-distance transportation and energy storage (...) Alternatively, after the removal of CO₂, biogas can be upgraded to natural gas quality. CH₄ content higher than 90% can increase the heating value giving more utilization possibilities as a renewable energy source. Upgraded biogas (biomethane) can be used as vehicle fuel, or it can be injected into the existing natural gas grid (...) The most common methods of biogas upgrading include water scrubbing, pressure swing adsorption, polyglycol adsorption, membrane separation, cryogenic separation and chemical treatment. Generally, these methods are performed outside the anaerobic reactor and require investments in external equipment. Therefore, the cost is relatively high. The main disadvantage is that small amounts of CH₄ are also removed, which can increase greenhouse gas emissions. To circumvent these disadvantages, **biological conversion of CO₂ to CH₄ for biogas upgrading can be achieved** [Sabatier reaction] (...) With our research project we intend to use the excess energy of renewable sources such as wind mills in order to produce high CH₄ content biogas. That way, in times of energy oversupply the excessive energy could be converted into a storable gas. More specifically, our objectives are:

- supply hydrogen to the organic waste feeding stream of the anaerobic digester with the goal to convert carbon dioxide from biogas into methane in situ.
- modify the anaerobic configuration so that H₂ is used to upgrade the biogas efficiency, and to
- optimize H₂ consumption by the hydrogenotrophic methanogens in anaerobic reactors (...)

Overall, the expected outcome of this project is **to implement an efficient process for converting the excessive renewable energy into CH₄**. This process will result in increased net CH₄

production for biogas plants, decreased biogas upgrading costs and the possible use of biogas as an alternative to natural gas. The main benefit will be the use of the existing infrastructure system for storing electricity.”

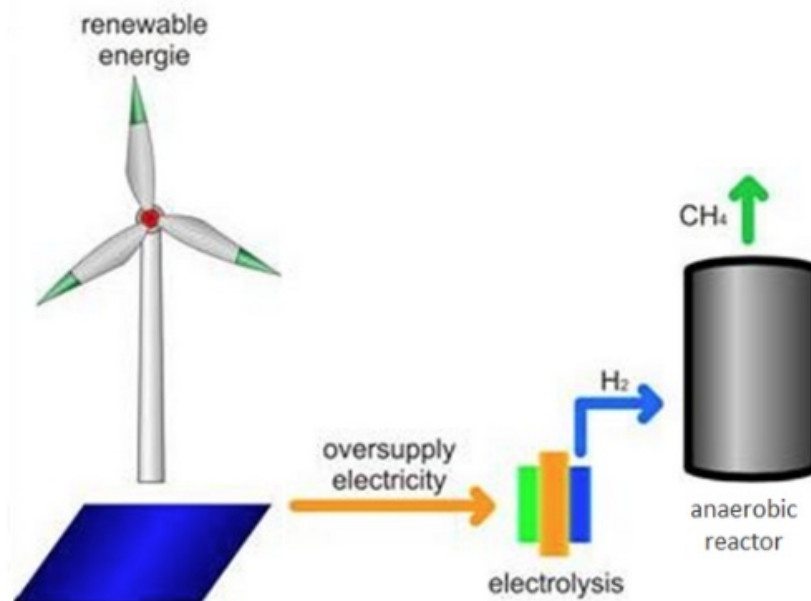


Figure 5: Use of surplus electricity to biogas plants via hydrogen

“Taking care of the future through collective stewardship of science and innovation in the present”

August 3, 2015. **New Principles For Responsible Innovation, have your say!** Redazione Fondazione Bassetti. “As part of the European Commission's Digital Agenda for Europe, Hilary Sutcliffe of the UK based think-tank MATTER has launched the [New Principles for Responsible Innovation document](#). The document is an open call for comments”

June 24, 2015. **What responsible innovation means**, simply explained by J. Hankins, [Fondazione Bassetti](#) foreign correspondent. “The goal of RI is to make the entire innovation process responsible, and not merely individual engineers, scientists or entrepreneurs. A decade ago RI was practically unheard of, with scattered individuals in universities across the globe connecting through a loose network of interests, or working with non-academic partners on the fringes of policy-making and politics. Today the community boasts RI university chairs, dedicated blogs, book series, and a growing global network. The concept is still in its infancy, and as a result definitions abound within a rapidly expanding body of literature both from academic and non-academic sources. One of the most commonly cited definitions of Responsible Innovation comes from Rene von Schomberg, team leader of science policy at the European Commission: “Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).” Another broader and somewhat simpler definition comes from Jack Stilgoe, Richard Owen and Phil MacNaghten: “Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present.”