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Special | Spring 2015

Challenge #1 **On cooling down**
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Marga Edens
RWE/Bettercoal

6 Major Challenges
Energy

Marga Edens (1958), Vice President Corporate Responsibility of RWE AG and Chair of the Board of Directors of Bettercoal.

Who is Marga Edens?

P+ People Planet Profit invited Edens to write this series in order to provide a look behind the scenes of the European energy industry. RWE is one of the continent's major players and is undergoing a transformation as a result of the growth in localised energy systems.

Before taking on her role at the RWE headquarters in Essen, Edens was Manager of Corporate Responsibility at Dutch energy company Essent. There, she worked on the development of a professional tool for measuring and monitoring companies' corporate social responsibility. She also initiated a dialogue between energy companies on improving transparency in the coal supply chain. Finally, she encouraged the 'circular energy' concept, culminating in Cradle to Cradle certification. In Essen, Germany, she continued this work at a European level, engaging in dialogue with various stakeholders, including international environmental organisations. She travelled to Colombia with a group of NGOs and directors of coal purchasing energy companies to personally witness how coal is extracted there.

More recently, she has been involved in the Energy Academy Europe (EAE), affiliated to Groningen University. Here, education, research and innovation on the subject of energy are brought together. In the north of the Netherlands, natural gas is – still – being extracted. The area is rapidly developing as a centre of knowledge about transitioning towards renewable energy. In the academy, Edens is Senior Manager, Power and Coal Industry.

Edens originally studied law at Utrecht University. This was followed by post-graduate courses in CSR and Business & Human Rights at Harvard Business School.

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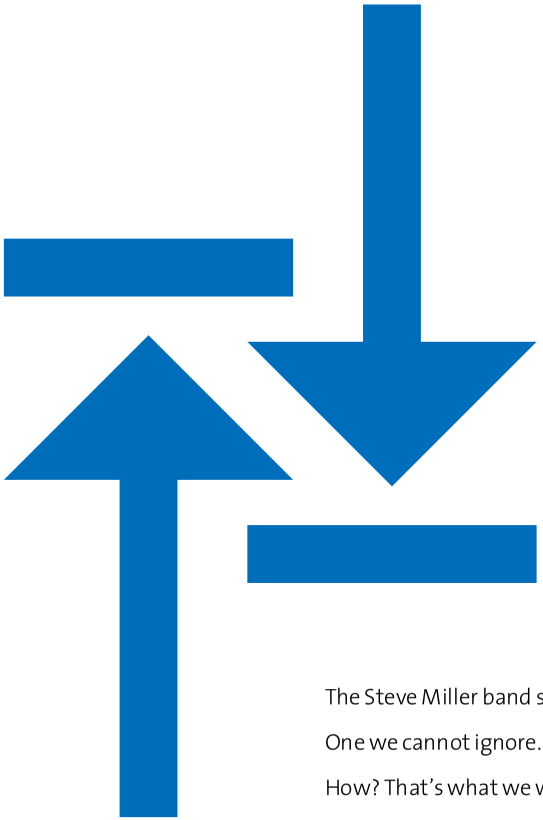
Why wait for the lights to turn green?

Energy Crossroads

Major Challenge #1 **On cooling down**



Heat up or cool down?

The Steve Miller band song could be Mother Earth's lament. One we cannot ignore. Global warming needs to be halted, soon. How? That's what we want to examine in this issue of "Energy Crossroads". According to Marga Edens, Vice President Corporate Responsibility of RWE AG, energy efficiency is the fastest solution.

I heat up, I can't cool down
You got me spinnin'
'Round and 'round
'Round and 'round and 'round it goes
Where it stops nobody knows

Abracadabra, Steve Miller Band

"Hey, my feet are getting wet. I need to move my beach chair back. But I thought I was already above the flood line! I can't move back any further or I'll be sitting on the boardwalk." Minor discomfort during my holiday last year on Borkum, one of the German Wadden islands. It was explained by an unfortunate series of events: a strong sea wind, chasing the waves onto the beach, which had eroded during the previous autumn storm. Easily addressed by deciding not to have lunch on the beach, but on the boardwalk. Seated there, I wrung the last drops of water from my socks and looked out over the stormy sea. The boardwalk was designed to deal with it. It was even ready to face higher water levels.

The same could not be said of many other artificial and natural embankments elsewhere in the world. If sea levels rise further – and according to the most recent IPCC report, they will likely rise another 26 to 82 cm this century – large tracts are in danger of disappearing underwater forever. Countries like Bangladesh and the island of Tuvalu have to yield area or disappear beneath the waves. What boardwalk can their inhabitants seek out?

Rising sea levels are a symptom of global warming. Seawater heats up as a result of higher temperatures and expands (about one meter rise per degree Celsius). Melting land ice nudges absolute sea level rises along. The warmer climate also has other negative side-effects: extreme weather (heat waves, persistent drought, heavy rainfall, flooding, off-the-charts hurricanes) which in turn have a negative impact on living conditions for humans (food and water shortages, tropical disease epidemics and plagues), animals and plants (shrinking biomes and decreasing biodiversity). If the world is to remain inhabitable in the face of these mechanisms, global warming must be limited to no more than 2 C above the pre-industrial level by 2050. This is the limit defined by EU leaders in 1996 based on the international Climate Convention drawn up in 1992 in Rio de Janeiro. The conference marked the first time the question was asked explicitly: heat up or cool down?

That the question was formulated as a choice suggests a relationship between climate change and human activity. That relationship exists. The 2013 IPCC report notes that it is 95-100% certain that humans – that means us – are the primary cause of climate change. By emitting increasing amounts of greenhouse gasses into the atmosphere, we have raised global temperature by 0.8 °C, and according to the International Energy Agency (IEA) and the World Bank, are on course for a 3.6 to 4 °C increase by 2050, far beyond the planetary boundaries. If we hope to turn this tide, Greenhouse Gas (GHG) emissions must peak by 2015, and then quickly drop, preferably to 0 by 2050.

Two-thirds of global GHG emissions are currently caused by the energy sector. The combustion of fossil fuels for energy production generates carbon dioxide (CO_2). If we consider the amount of CO_2 we may emit in order not to exceed the 2 °C limit a budget, we have 800 billion tons available worldwide. That may seem like a lot, but since 1870 – the start of the industrial age – we have already burned through 50%, at increasing rates. Additionally, the available coal, oil and gas reserves are so large that the remaining budget can easily be exceeded many times over.

Furthermore, the IEA expects global electricity consumption to increase by over two-thirds between 2011 and 2035. If nothing changes, the energy sector will meet growing demand with an energy mix dominated by a 57% fossil fuel share (mostly coal). Corresponding CO_2 emissions will rise from 13 gigatonnes in 2011 to over 15 gigatonnes in 2035. This is hardly the road to achieving a 2 °C temperature increase by 2050.

So what can we do? We need to switch to a low/no-carbon energy system. This transition costs money (currently, 2% of the global gross social product, a percentage which increases the longer we wait) and time (while greenhouse gasses accumulate in the atmosphere and we continue to invest in long-lasting high-carbon infrastructure which locks in future emissions). That is why we must begin addressing our energy consumption today. How? By seriously addressing energy efficiency. In all sectors of our economy (within or outside of the European Emission Trading Scheme) and all levels of society (households, businesses and governments). Higher energy efficiency will result in less primary fuel or power consumption for a product or service of equivalent quality. We are not (yet) talking about adjusting our standard of living, but modifying our behaviour and our processes.

Dealing with energy more efficiently delivers environmental, social and economic advantages: lower CO_2 emissions (better for climate and health), lower energy bills (households with more disposable income, businesses with a stronger competitive position), more innovation and investment (in buildings, transportation systems, electricity networks, etc.), providing a stimulus for the economy. That the potential of energy efficiency is insufficiently being harnessed is due to misaligned financial incentives (the investor does not always benefit), high up-front investment, combined with insufficient financing opportunities, different investment or consumption priorities, and lacking information and transparency.

Unfortunately, some governments are losing sight of the importance of energy efficiency. The European Union in particular is showing a shift in priorities. In 2014, European government leaders decided on new (binding) agreements for the period after 2020, a renewal of the earlier EU climate and energy package. Despite the urging of the European Parliament and a number of European governments to define strict energy efficiency goals, the European Council didn't wish to spearhead energy efficiency – a missed opportunity! If European government leaders were to confirm energy efficiency as a key instrument for achieving our long-term climate goals, it would be a clear signal that all of us need to contribute. Households and companies by making consumption and production more energy efficient, governments by facilitating households and companies with information, regulations and financial incentives. But also by investigating whether energy efficiency measures can be introduced in sectors not covered by the Emissions Trading Scheme, such as transport and buildings.

Energy efficiency can make a key contribution to the decarbonisation of our world on the road to 2050. Even greater efforts will also be required, but energy efficiency is something all of us can start with today. We have no choice in the matter. This is about more than a beach chair and a pair of drenched shoes. The response to global climate risks can only mean one thing: reducing emissions. That is why we must begin using our energy more efficiently, starting today. ■

The price is right. Or is it?

The words that still remain
always stay the same.
Is grief the price we pay,
the price we pay?

THE PRICE WE PAY, KING CRIMSON

Is the price we pay for energy the right price? The level of the electricity tariffs varies hugely in the different countries of Europe. Also the taxes for households and industrial electricity differ. This competition occurs also between Europe and the United States, where electricity prices are 50% lower. The best advice? Energy prices must be reduced, argues Marga Edens, Vice President Corporate Responsibility of RWE AG.

"That's virtually free of charge", I said to my brother when he told me how much I had to pay the utility. "Are you sure the price is right, or have they forgotten a zero?" That was the one and only time I have ever wondered whether my energy bill was too low. But the context explains a lot. I was 10 years old and my brother, two years my junior, was the triumphant owner of the Electric Company, one of the properties on the Monopoly board.

Now, I tend to wonder the opposite – like many other energy consumers along with me: am I not paying too much? Isn't the price of energy too high? In order to be able to answer this question, we first need to know how an energy tariff is put together. All European energy companies actually use a similar structure. If we look closely at their electricity tariffs, from households right through to bulk industrial consumers, we find the following com-ponents: commodity and production costs, transport costs, supplier costs and taxes and levies. But that's where the similarities stop. The level of the electricity tariffs varies hugely in the different countries. The difference in the proportion of the tariff made up by taxes and levies is even more extreme. Eurostat figures for the first semester of 2013 demonstrate this at a glance (see statistics 1 - 4, page 6). The situation in Germany stands out immediately. There, taxes and levies now make up more than 50% of the household electricity tariff. This is because the shift to renewable energy, known as the Energy Transition, has so far progressed more rapidly in Germany than in other European countries. The cost of this is recovered from consumers through a range of taxes and levies. But in most other European countries the government also accounts for a substantial portion of the energy tariff – and its increase. If we compare the first semester of 2013 with the same period in 2012, the increase was quite significant (see statistics 5 - 6, page 7).

These increasing prices present a problem both for industry and households. For industry, because energy costs are a key factor in determining competitiveness, especially if energy makes up a significant proportion of the total production costs and the end products are destined for export. In most European countries, the manufacturing industry is still an important economic factor that makes a substantial contribution to the national economy (in Germany 24%, in the Netherlands 18.6% and in the UK 15.5% – Eurostat 2010). This industry creates jobs, both directly and indirectly in the service sector. The interaction between industry and industry-related service providers is essential for ensuring innovation, growth and employment. The (energy-intensive) industry in countries with high energy prices is at a competitive disadvantage. This competition occurs between European countries, but also between Europe and the United States, for example, where electricity prices are 50% lower. If these differences become even greater, businesses will reconsider their investment decisions and conclude that it makes more economic sense to invest elsewhere. The effect of this investment leakage could be de-industrialization in some countries. That would obviously have multiple negative consequences in terms of innovation, growth and employment. Domestic households, on the other hand, will not opt to move to another country for this reason. The price elasticity of their energy demand is also low. Despite continually increasing prices, households do not engage in major cost-cutting when it comes to energy expenditure since energy is a primary necessity of life. As a result, they need to spend an increasingly larger portion of their net income on energy. If 10% or more of the household budget is used on the energy bill, this is classified as energy poverty. According to a British survey from 2013, 8.1% of households in the Netherlands suffer from energy poverty; in Germany that figure is 12.6% and in the UK it is as high as 19.2%. (However, the high UK figures are in part caused by the often poorly-insulated housing). If policy remains unchanged, the percentage of households burdened by high energy costs will increase rapidly in the years ahead.

High energy prices therefore have far from pleasant consequences. As a society, we might be prepared to accept this for a certain period, if we had the certainty that these high prices would help us progress towards a more sustainable energy supply. But that is not happening: the proportion of renewable energy is growing disappointingly slow. At a European level, we have to do our very best to achieve 20% by 2020. For the decade after that, our ambitions appear to stagnate at around 27%.

The main reason why energy prices are so high is because the government imposes all kinds of taxes and levies on top of the directly accountable costs. Anyone who expects these levies to benefit the energy sector and increase sustainability will be disappointed. Most of the money becomes part of the general resources that the government uses to finance all kinds of policy areas.

We also need to realize that much of the cost to society of today's predominantly conventional energy supply (the environmental impact, for example) is not accounted for in the energy prices. If we also included these so-called external costs, energy prices would rise still further.

This is why it is time that we took a renewed look at the price of energy. It is not a question of adapting one or two components of the price, but rather asking ourselves whether the price we pay covers all of the costs associated with energy *and* whether (temporary) additional levies will bring a sustainable energy supply a step closer. We need to break the current vicious circle. Energy prices must be reduced. And this can happen if governments stop levying too much tax on energy without using the revenue for increased sustainability and if energy companies open their eyes to the costs they cause for society. Governments and energy companies must jointly take responsibility for a gradual transition towards a sustainable energy supply and for pricing energy in a way that achieves that sustainability. This would result in a different breakdown in the tariff and – in the long term – in a lower price.

If that happens, I will happily take out my game of Monopoly again, in the hope that this time it will be me who becomes the owner of the Electric Company. ■

Household electricity prices-including taxes and levies

Annual electricity consumption 2,500 kWh - 5,000 Kwh (Eurostat Band DC)

Proportion of taxes and levies in electricity price

Annual electricity consumption 2,500 kWh - 5,000 Kwh (Eurostat Band DC)

Industrial electricity prices (bulk consumers)-including taxes and levies

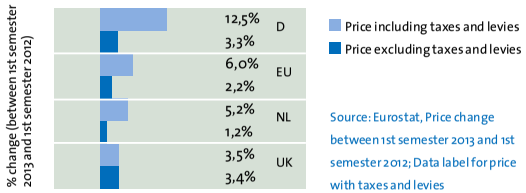
Annual electricity consumption 70,000 MWh - 150,000 Mwh (Eurostat Band IF)

Proportion of taxes and levies in electricity price - without recoverable taxes, including levies -

Annual electricity consumption 70,000 MWh - 150,000 Mwh (Eurostat Band IF)

Source: Eurostat Situation as at: 1st semester 2013 (average)

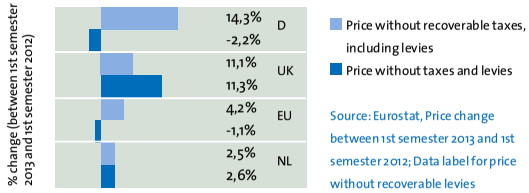
Price changes in household electricity



Annual electricity consumption 70,000 MWh - 150,000 Mwh (Eurostat Band DC)

Source: Eurostat, Price change between 1st semester 2013 and 1st semester 2012; Data label for price with taxes and levies

Price changes in industrial electricity(bulk consumers)



Annual electricity consumption 70,000 MWh - 150,000 Mwh (Eurostat Band IF)

Source: Eurostat, Price change between 1st semester 2013 and 1st semester 2012; Data label for price without recoverable levies

Small. The new big?

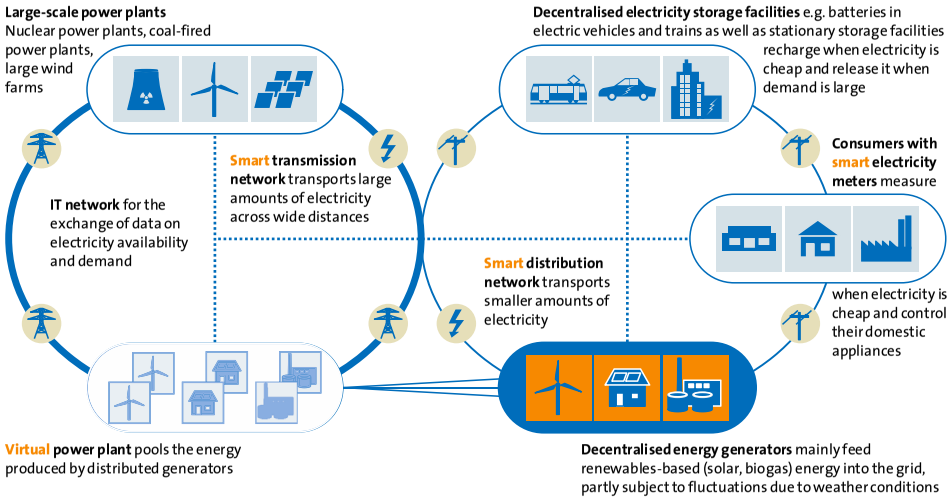
"Life is just heaven in the sun
From small things, mama
Big things one day come"

+ From small things, Bruce Springsteen

Private households that undertake the decentralised generation of power and heat now represent 22% of the total energy production in Europe. All of those small contributions have now grown into something much bigger and those producers should now share some of the responsibilities of the major players in our energy supply, says Marga Edens, Vice President Corporate Responsibility of RWE AG.

+ Infographic Roland Berger Strategy Consultants

The energy system of the future



I didn't know the young man standing at the threshold of my front door. He'd just rang the doorbell and was now busy explaining how I could form an energy collective together with other homeowners in my district. "We're going to generate energy together. Using solar panels. If 100 households take part we'll be able to buy those panels cheaper and start generating a return immediately."

If we generate energy ourselves, he summarised, we'll no longer be dependent on an energy company, we'll no longer have to pay energy prices that keep rising and rising and we'll be reducing our CO_2 emissions. He handed me a bright orange leaflet and looked at me full of expectation. As an employee of an energy firm with large-scale, fossil-based energy production, I listened with increasing interest. So, this was the competition and he knew how to convey his message well.

Our energy supply is not something we contemplate every day. Electricity is something we've become accustomed to, it's something we take for granted. We've organised our existence, our society, in such a way that we can no longer do without electricity. It has become one of our vital necessities.
The utility firms that laid down the foundations more than a hundred years ago for our current energy supply and who have since taken responsibility for its operation, are very aware of the importance of electricity for our prosperity and welfare. They actually define that importance in terms of availability; however, they also translate it into two other necessary conditions, namely affordability and sustainability. Combined, these three criteria (availability, affordability and sustainability) form what is known as the Trias Energetica. The energy firms try to keep that in balance as much as possible. There are disadvantages associated with an energy supply that is mainly affordable but which (as a result of that affordability) is not sustainable and not sufficiently available. The same applies to an energy supply that is geared completely towards availability or sustainability. It is therefore important that the correct balance is maintained between these three dimensions. How is that achieved in practice?

In the majority of European countries energy is produced by multinationals with large-scale and, therefore, cost-efficient power stations. These are often conventional or hybrid power stations (running on gas, coal or a combination of coal and biomass), however, there are also increasing numbers of installations that only use renewable sources of energy such as large-scale on-shore and off-shore wind farms. In 2012, 27.7 % of the large-scale energy generation in the European Union was derived from renewable sources (wind, solar, hydro, biomass). The average consumer price was 20.02 eurocents per kWh, with a rising trend. The average duration of power cuts caused by electricity network failures was approximately 50 minutes, with a declining trend.
Is that good or not? According to many European energy customers that is, in any event, not good enough. The combination of their growing concern for climate change as well as increasing energy bills and the availability of new technology have led them to take control themselves. Consumers are becoming 'prosumers': producing consumers. Until recently energy firms had the 'power', both literally and figuratively, but now they have to share that with others. In the EU around 22% of all energy is now generated in decentralises systems by prosumers. This means that nearly a quarter of the total production of electricity is undertaken without utilising the large-scale production capacity of the incumbent energy firms. What does that do to the Trias Energetica and the necessary balance between availability, affordability and sustainability?

The trend towards decentralised generation has given an enormous boost to renewables. Prosumers generally opt for small-scale renewable solutions that use solar, wind or geothermal power. For them personally that (in due course) generally improves the affor-dability. The result of this is actually that the costs of existing large-scale facilities have to be passed on to a smaller group of energy consumers. However, the greatest impact of decentralisation is on availability, for which there are two causes. Decentralised energy production is less predictable because dependency on the weather increases. On sunny, windy days a lot (in fact too much) energy is produced but on cloudy, calm days insufficient energy is produced. The large number of small suppliers also results in fragmentation of the energy supply and lack of clarity about responsibilities. How do we manage surpluses and shortfalls? How do we link up all of those solar panels and micro –CHP units? How do we integrate all of these small, private systems to facilitate a large supply of power that is available 24/7? We achieve this by organising the energy supply differently: see the diagram.

Two principles form the key to this: smart and virtual. The energy supply in the future is all about smart meters, smart grids and virtual power plants. Smart meters provide consumers with decision-making information (level of consumption, time-of-use pricing, etc.). Combined with being able to control their heating, lighting and other energy-consuming devices remotely, that information allows them to undertake their own active energy management. One way of allowing the many small, decentralised generating systems to play a central role in the future energy supply is to regard them as a single entity, as a virtual power plant. Many small units form one big unit. As an initial step, the decentralised power that they produce individually can be combined together and offered centrally on the power market. Ultimately, those decentralised units will also have to be linked up physically and managed centrally if they want to be able to make their essential contribution towards maintaining the availability, affordability and sustainability of our energy supply. That requires smart grids – the physical connection between all individual links in the energy supply chain. By utilising innovative information and management technology, the smart girds are able to link all of this (decentralised) energy production and decentralised energy storage together with consumers and their smart meters, thus creating a coherent and collaborative entity.
It is not just down to the energy firms to turn this future vision into reality. It is necessary that carefree, passive energy consumers change into conscious, active energy generators and energy savers and start to act like partners of energy firms. Individual, small prosumers also have to be accountable for the major interests that are at stake. Because "with the power comes the responsibility".
In the meantime, I'm still at my front door threshold holding that orange leaflet in my hand. Shall I throw it in the old-paper bin or shall I read it? And is that the sun I see coming out ...? ■

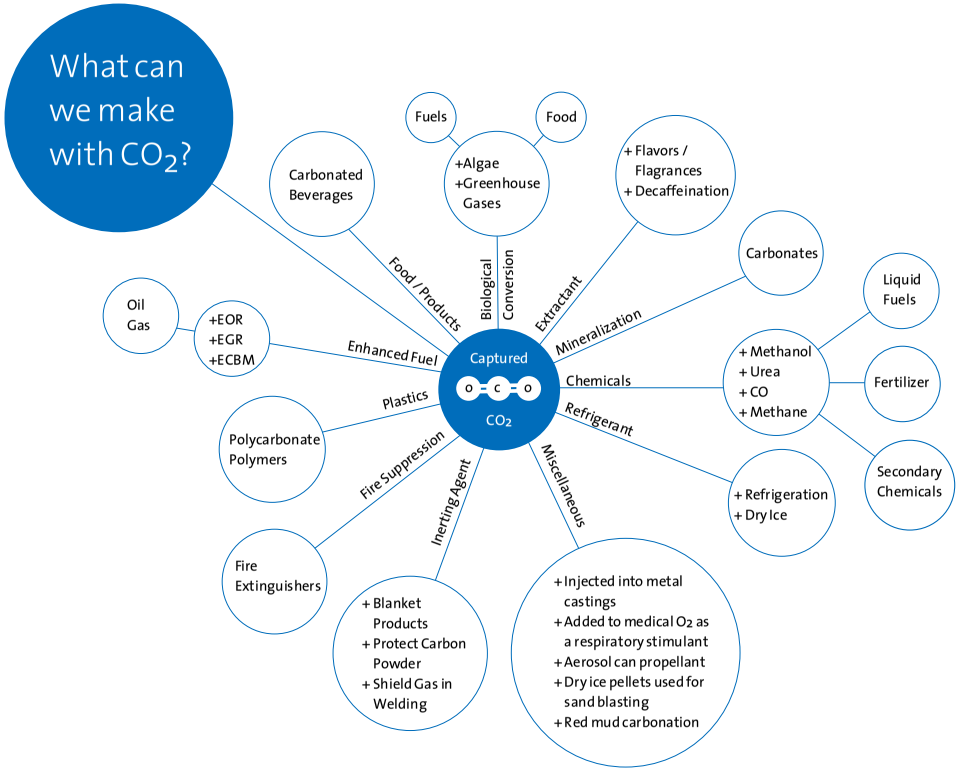
High hopes for low carbon?

"Nobody said it was easy
No one ever said it would be this hard"

THE SCIENTIST – COLDPLAY

It is better to use CO_2 as a product than to store it underground. Scientists are exploring solutions along three different pathways. One of these is to use the greenhouse gas as a nutrient for algae in order to produce biofuels. It should be possible to prevent 10% of annual emissions, argues Marga Edens, Vice President Corporate Responsibility of RWE AG.

+SOURCE INFOGRAPHIC: NATIONAL ENERGY TECHNOLOGY LABORATORY



Dr. Bunsen Honeydew. Remember him? He was my favourite Muppet character. In each show, he used to greet us in his Muppet Labs, "where the future is being made today". He truly was a free spirit, who was far ahead of his time with solutions for problems that did not (yet) exist. Will there ever be a need for a banana sharpener or a gorilla detector? Probably not. But whatever surprises the future has in store for us, Dr. Honeydew already had them in his sights today. For me, he proved how important unconventional thinking is: a willingness to look beyond the more obvious solutions. To put it more strongly: the need to question established views at every turn and to keep an open mind.

I would like to apply this mindset now to re-examine a familiar environmental problem: CO_2 emissions, and their continued increase worldwide. In P+, issue 4 (March/April 2014), I took a detailed look at the link between CO_2 and the consequences of climate change, such as heatwaves, persistent drought, heavy rainfall, flooding and off-the-charts hurricanes. I, like many others, also called for a reduction in the amount of CO_2 that we dump into our living environment. It is therefore explicitly not my intention to question the effect that CO_2 is assumed to have on climate. However, I also do not want to simply assume that we can achieve the necessary reduction in CO_2 emissions by 2050 by means of a far-reaching decarbonisation of our energy and transport sectors. For now, I will take the amounts of CO_2 and their damaging impact as a given. What I would like to do is ask whether we have an alternative solution for these still very large quantities of CO_2, other than the generally-accepted capture and storage option. Is there something else we can do with CO_2 rather than burying it in the ground? Can we make something with it? Can we productise CO_2? Can we replace storage with usage? Usage on an industrial scale, as a result of which large volumes of CO_2 can, with the help of some creative science, have a positive impact on our environmental balance-sheet?

The current common or garden applications for CO_2 are familiar to us all. In the food and beverage industry, CO_2 provides the fizz in our soft drinks, decaffeinates our coffee and keeps perishable produce at the right temperature. That's cool, but completely inadequate as a means of combating global warming. This is why scientists have started a quest for other ways of recycling CO_2 on a large scale. Key to their innovative approach is the need to develop solutions that are actually beneficial. There must be a guarantee that this kind of new application does not result in more CO_2 being produced than is already available from power plants and industry. This kind of new application also creates its own demand for energy. It must be guaranteed that the extra energy required does not cause more CO_2 than the total amount that can be processed in the new application. If renewables are used to fulfil this need for energy, the application could actually be carbon-negative!

For the utilisation of CO2, scientists are exploring three major pathways: non-conversion CO_2 use (primarily enhanced oil recovery), converting CO_2 into (bio-renewable) fuel and using CO_2 as a feedstock for chemicals. The graphic shows all of the current and future applications of CO_2 together.

In enhanced oil recovery (EOR), CO_2 is used to force the residual oil from a mature field. CO_2 is injected into the ground (in other words, stored), as a result of which the remaining oil is pushed to the surface. According to the International Energy Agency (IEA), this method can be used to produce between 5 and 20% extra oil and increase the exploitability of an average oil field by up to 50%. In the case of EOR, CO_2 is actually used more as a means to an end (the main aim is to increase production). The CO_2 used (according to IEA estimates, with a cumulative potential ranging from several to hundreds of gigatons) is stored permanently underground and is not used for an alternative, innovative purpose. This is why the two other methods of making CO_2 productive are more interesting.

The conversion of CO_2 into fuel delivers new products that can be manufactured in several different ways. Stimulating the growth of micro-algae is one of the most well-known examples. The IEA anticipates that by around 2050, 27% of all transport fuel will originate from biomass-based sources (compared to 2% now), which alone can prevent two gigatons of CO_2 emissions every year. Other methods of CO_2-to-fuel conversion can achieve signi-ficantly greater reductions in emissions.

Even more mind-boggling is the transformation of CO_2 into concrete, tangible, everyday products, like memory foam for cushions and mattresses, for example. That "Dream Process" is currently under development by Bayer, using CO_2 originating from the nearby RWE coal-fired power plant. The resulting material can consist of as much as 40% CO_2. On a global scale, the conversion of CO_2 into memory foams, plastics and building materials could ultimately process between 1 and 2% of emissions.

If we add together the proven CO_2 utilisation potential of all three pathways, we reach around 3.7 gigatons per year. That is approximately 10% of current annual worldwide CO_2 emissions. Even if we take into account much more complicated applications that will not become available for at least a decade, we are still forced to conclude that the utilisation of CO_2 will not solve our emission problem. When I consider all of the utilisation options, I never fail to be astounded by our scientific ingenuity. I had never thought that I would ever be able to sleep or even live in CO_2. Despite that, CO_2 utilisation is at best an interesting addition to CO_2 capture and storage and not a fully-fledged alternative. If we do not want CO_2 to become another "natural resource" hidden in the ground, the solution to the CO_2 problem will ultimately need to come from an absolute reduction in our CO_2 emissions. There are no magic solutions. Hard work and effort will be necessary. But, to quote my other Muppet hero, Kermit the Frog: "It's not easy being green." ■

Better coal than before?

"I ain't as good as I'm gonna get
But I'm better than I used to be"

'Better than I used to be', Tim McGraw

What to expect from the promise of better coal, including improved social conditions for the mineworkers in far away countries? The process has started. A group of major coal buyers, representing more than 56% of the total amount of coal imported into Europe, wants to bring change on the ground. It will take some time, however, before Bettercoal's impact will become apparent.

My great-great-grandfather's cargo ship was a square-rigged brig, which bore the name *Redite*. Its home port was Veendam, the Netherlands, and it had a capacity of less than 250 tons. Nonetheless, around 1870 it was an important link in the maritime supply chain between England and the ports of the Baltic Sea. Timber and grain were loaded on board in Riga and Gdansk, bound for buyers in England. The return freight was mostly coal, personally loaded on board by my great-great-grandfather, who was both captain and stevedore. Mainly from Newcastle upon Tyne, because he preferred the coal mined in Northeast England: good in both quality and price.

Today, coal is still primarily transported by ship, although that's about where the similarities with the coal trade of 150 years ago end. The current market is much more compli-cated, having grown into a worldwide field consisting of a finely-meshed global network of suppliers, traders, financiers, transporters, and buyers. The volume traded has, moreover, multiplied several times over.

In 2011, around six billion tons of coal were produced worldwide, of which about 140 million tons were transported (mostly by ship) to Europe from such countries as Indonesia, Australia, Russia, the USA, Colombia, South Africa and Canada.

A fact that hasn't changed is that coal is still being used to produce energy. In spite of the transition in energy production and European agreements to reduce the CO_2 emission, about 17% of our electricity is produced with the help of bituminous coal, while another 10% is produced with the help of brown coal (lignite). The International Energy Agency expects that coal will remain an important fuel during the coming decennia.

Against that background, it is easily understandable that society has adopted a very critical attitude towards coal, both in terms of its use and its provenance. In a number of European countries, including the Netherlands, Germany and Denmark, the coal supply chain has been put on the agenda, especially by NGOs. These NGOs are of the opinion that energy companies, as large-scale consumers of coal, should not limit their responsibility towards society to their direct business partners alone, but should also concern themselves with the situation in the countries of origin. In 'black books' like "The true cost of coal" (Greenpeace, 2008), NGOs point to a whole range of negative consequences for society from the effects of coal mining, including unhealthy and dangerous working conditions in coal mines, violations of human rights in neighbouring local communities and extensive environmental pollution. Energy com-panies ought not just stand by doing nothing, but take responsibility. This means, according to these NGOs, that they must at least be transparent about the origin of the coal that they use, so that their customers and other stakeholders are able to judge the extent to which these companies are taking the problems mentioned above into account in their purchasing policies.

At first consideration, this would appear a justifiable point of view, but is it also feasible? In most cases, energy companies use a mix of coals, which are supplied by either a trading firm, or their own wholly owned trading firm or commercial division. A trading firm puts together a blend of coals, chosen from among its portfolio of purchasing contracts, on the basis of a company's quality requirements. In both import and export harbours, coal that originates from various mines and various owners can be mixed into a blend according to the desired quality proportions. Due to this degree of complexity, energy companies are often still capable of identifying their coal's country of origin, but not the specific coal mine.

This does not mean that energy companies are incapable of or do not wish to contribute to the improvement of the situations in and around coal mines in export countries. With regard to this, one must take into consideration that the export capacity of an average coal mine is often many times greater than the purchasing volume of any single energy company, and that therefore a collective approach would have the greatest impact. That is why in 2012 seven large energy companies, Dong Energy, EDF, Enel, E.on, GdFSuez, RWE and Vattenfall, joined together to establish the Bettercoal initiative.

These companies envision a coal supply chain that respects the rights of people and the environment, and that contributes positively to the livelihoods of workers, producers, and communities. They want to promote the continuous improvement of corporate responsibility in the coal supply chain, by improving business practices through engagement with stakeholders, based on a shared set of standards. To achieve this goal, they have developed the Bettercoal Code, which establishes leading practices for ethical, social and environmental performance of coal suppliers. The Code was discussed with a number of stakeholders (civil society and mining companies) during roundtable discussions in Colombia, Russia, Indonesia, South Africa, and Europe.

The Bettercoal Code consists of ten principles covering a series of issues relating to the mining of coal to which mining companies should adhere, such as: companies shall respect human rights, support the development of local communities, promote the sustainable use of natural resources and protect biodiversity. Bettercoal members, of whom by this time there are more than 10, are expected to embrace these principles. To this end, they need to obtain supplementary information from coal suppliers. This information is becoming available through so-called 'self- and site- assessments', to be carried out according to the Bettercoal Code. Based on this Code, Bettercoal has developed a Self-Assessment Questionnaire (SAQ), which suppliers can use to assess their own performance. SAQs are stored in the database of Bettercoal, to which only its own members have access. Information gained from an SAQ can lead Bettercoal to request that a supplier have an on-site assessment carried out, which assessment is then carried out by independent auditors, using the Bettercoal Assessment Protocol. Their audit report and the possible Corrective Action Plan (in which measures to be carried out by suppliers are linked to deadlines) are also accessible for Bettercoal members via the Bettercoal database.

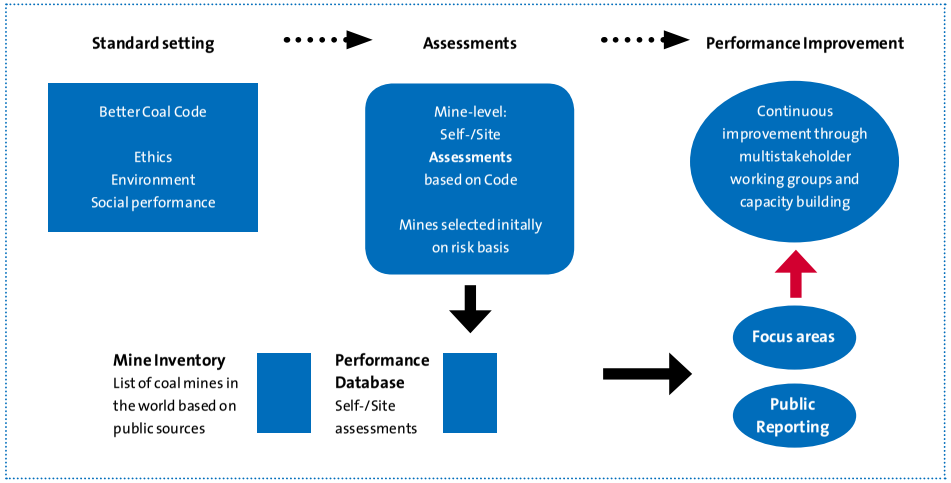
In just over two years, Bettercoal has moved from the development of a new mining Code and Assessment Toolkit through to actually commissioning mine self-assessments and on-site assessments. In June, it completed its first ever site-assessment at Drummond Ltd.'s Colombian operations. Any opportunities for improvement were incorporated into a Corrective Action Plan that Drummond Ltd. has committed to implement. Bettercoal aims to commission more on-site assessments in the months to come.

In this way, more information is slowly but surely becoming available, which coal buyers can add to their purchasing criteria. Together, the current members of Bettercoal represent more than 56% of the total amount of coal imported into Europe. The collection of information takes time, but according to the affiliated companies, the approach being taken by Bettercoal is the best way to realise permanent improvements, both at the mines themselves, and beyond.

My great-great-grandfather went down with his ship, in a raging storm in 1877. Bettercoal is the only available vehicle that can pilot the global coal industry to a more sustainable future. We must not let it founder or sink before it reaches the harbour. ■

www.bettercoal.org

Bettercoal Operating Model



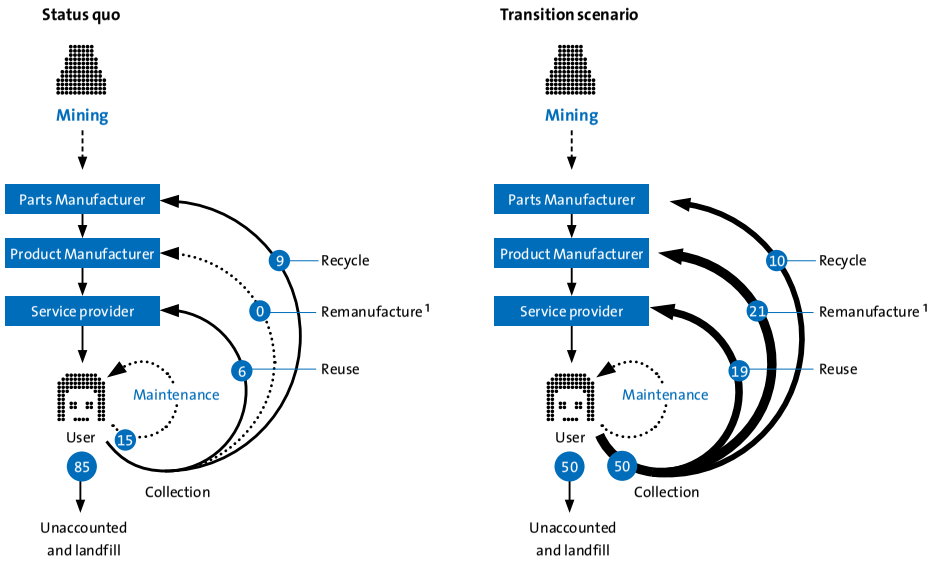
Major Challenge #6 **On circularity**

All the molecules
Every single one
The atoms
Their spin
Their charge
Their charm
All and every one
In circles

"In circles"
Einstürzende Neubauten

When Michael Braungart began his triumphal march across the Netherlands, there were also critical questions from the audience. "You can make products that are Cradle to Cradle, but what if the energy used for that production is not Cradle to Cradle?" Now the stage is set for supplying electricity certified and approved by Braungart. So, would the interested parties please step forward?

Going round in circles?



[1] Remanufacturing, here refers to the reuse of certain components and the recycling of residual materials.
Source: Gartner; EPA; Eurostat; UNEP; Ellen MacArthur Foundation circular economy team

Was it an underground carpark or did all those pipelines, valves, and measuring panels perhaps suggest that it was actually a basement used for heating? But if so, it was a pretty big one. At the time, at the beginning of 2008, my guide thought that these associations of mine did not show much respect for the immense challenge facing CERN. He was right. The quest for the God particle that was about to begin in Geneva was destined to make a major contribution to particle physics. The fact that I was given a chance to even take a look in the circular tunnel of the particle accelerator, the Large Hadron Collider, was almost a miracle in itself. Very soon, atoms would be spinning through the tunnel and colliding with each other in explosions of energy.

In our never-ending quest to understand our origin, we are learning more and more about smaller and smaller particles. And with every following discovery, it becomes increasingly clear to us that life is possible only because a certain balance exists at the microcosmic level.
We should apply this same insight at the macrocosmic level, to the earth and our use of it. The balance between ourselves and the environment we live in is starting to become quite disrupted. We use the earth as if it's a disposable item of which we have many more in reserve. We are producing goods and energy using resources that are in short supply and that are non-renewable. There must be another way to do this, and there is.

We need to organize our production processes in such a fashion that we do not use up our natural resources but instead use them in line with their capacity to recover from such use, in other words to focus on reusability in relation to everything we produce or make.

The first description of a circular economic and industrial system dates from 2002, when a book by Michael Braungart and William McDonough was published with the title "Cradle to Cradle: Remaking the way we make things." The authors describe a product cycle that does not go from cradle to grave but from cradle to cradle. Products do not end up as waste but instead are used as input for new production cycles that can be endlessly re-peated. In order to ensure that these production processes do not degrade the value of our resources but instead create value, Braungart and McDonough developed the Cradle to Cradle Certified Product Standard. With this quality standard, they aimed to discourage downcycling and encourage upcycling. In 2010, both originators transferred their product standard to the American Cradle to Cradle Products Innovation Institute, which by the way also has a branch office in the Netherlands. The institute has further developed the standard into a certification tool that supports product developers and manufacturers in a continuous improvement process.

One of the five assessment criteria is renewable energy and carbon management. The Product Standard states that the ultimate goal is "a future in which all manufacturing is powered by 100% clean renewable energy." The challenge faced by a producer in that regard is to "source renewable electricity (and offset carbon emissions for the product's final manufacturing stage)."

As Cradle to Cradle (C2C) is also based on the concept of continuous improvement, the required percentage of renewable electricity increases with the value of the certificate. For silver certification the applicable standard is that "5% of purchased electricity is renewably sourced (or offset with renewable energy projects)" and that percentage increases to 50% for gold and 100% for platinum.

As one of the biggest producers of renewable energy in the Netherlands, Essent (a subsidiary of RWE) has of course also studied the C2C concept. Even before the C2C Products Innovation Institute published a detailed explanation of the product standard, Essent had asked Michael Braungart to carry out a study into the criteria for C2C energy. In a report commissioned by Essent in 2010, Braungart wrote "C2C applied to energy means a key focus on the use of current solar income: electromag-netic radiation from the sun, either directly or after conversion to other forms. It is available directly through technologies such as solar thermal, photovoltaic, photochemical, wave and wind energy, thermal mass storage, and heat exchange with ground, water and air. Secondary solar uses include biomass-derived energy from composting, biodigestion, (hydro)thermolysis, pyrolysis, gasification, and energy from fuel cells using fuel derived from biomass."

By now, the C2C Certified Product Standard also includes several regulations of a technical and/or administrative nature. One of these is that, in the US, Green-e RECs (Renewable Energy Credits) must be purchased. Outside the US, the use of equivalent, verified RECs is appropriate. Green-e is the leading US certification programme for renewable energy.

All this may seem quite complicated and perhaps it is, but after serious consideration Essent has concluded that it can produce and supply C2C energy in the form of electricity as well as gas. However, there is still one important obstacle that the company needs to overcome, namely finding clients for C2C energy. In Europe, and especially in the Netherlands, there is a large community of C2C companies that produce in accordance with C2C principles.

So why are they not lining up to demand supply of C2C energy as a product as well as cooperation to achieve the transition of our entire industrial system towards C2C? Not only does the energy sector stand at a crossroads, but all of society. Regardless of whether we decide to take a left or a right turn, it will always be the wrong choice as long as it doesn't take us towards a circular economy driven by energy from sustainable sources.

Thinking back to that circular tunnel in Geneva with those tiniest of particles, I'm also reminded of the image that we chose when we started this series: the arrow. It was a symbol for the choices facing us. Now that this series is coming to an end, the time has come to reveal the answer. We need to think not in terms of left or right but in terms of renewable cycles. We should be going round in circles! ■

www.essent.nl

"The arrow is a symbol for the choices facing us. Which crossroads are lying ahead? Which direction should we take? Perhaps none. We need to think not in terms of going left or right, but in terms of renewable cycles. We should be going round in circles."

MARGA EDENS, ON ENERGY CROSSROADS

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