

# AFRY Insights

Energy transition



Spring 2022

## Interviews

Anna König Jerlmyr (Stockholm)

Jonas Gustavsson (AFRY)

Katherina Reiche (Westenergie)

## Topics

Dependence on fossil fuels

Hydrogen – energy source of the future

Green Financing



## Imprint

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### THANKS TO

AFRY, Gettyimages,  
City of Stockholm,  
Visual Capitalist, Westenergie

## Editorial

Dear reader,

The ongoing war in Ukraine has destroyed many families and homes and in its cruelty forces everyone to take a point of view. AFRY has decided not to take on new projects in Russia and has initiated the process to exit the business in Russia. "We condemn Russia's aggression against Ukraine, and we have been shocked and saddened by the suffering it has caused. Our thoughts are with the people of Ukraine and everyone affected. AFRY will always take a stand for what we believe in. Consequently, we have decided to no longer take on new projects and initiate the process to exit our business in Russia with due care to our clients and employees," said Jonas Gustavsson, President and CEO at AFRY.

Staying in dialogue and exchange with each other is nevertheless and perhaps more than before one of the most important guidelines for us to follow. Which is why the backbone of this AFRY Insights is made of three interviews with strong leaders. Our talk on hydrogen with Katherina Reiche, CEO of Germany's Westenergie, subject, of course, was also security of supply in Europe, while Stockholm's mayor, Anna König Jerlmyr explained to us how she is building a city of opportunities for her citizens. Last but not least we spoke to our CEO at AFRY, Jonas Gustavsson on the particular importance of inclusion and diversity and the gathering people with bold ideas in our company. Because we at AFRY believe that change happens when people with brave ideas come together.

As always, your feedback and comments are welcome, so that we can improve our next issue. We remain curious and make it our mission to bring you new ideas, perspectives and insights in order to support you for what is coming next.

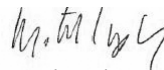
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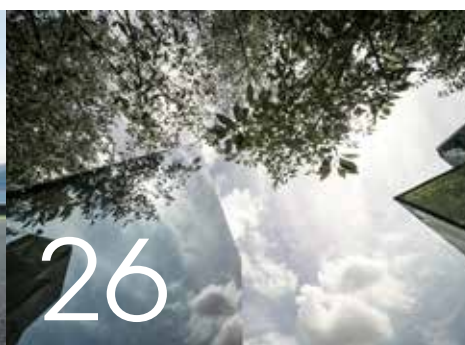
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Brave  
steps.  
Action  
now.



Recent events have once again reinforced the stark reality of our current dependence on fossil fuels. Even before the invasion of Ukraine, soaring energy costs were already hitting end users, both households and industrials. Now the concern is a much broader one of energy security and of dependence on Russian oil and gas, especially in Europe. Many responses have already been seen at a national and EU level. The question of how we can reduce dependence on Russia gas, and on fossil fuels more generally, is on the agenda of every Western political leader.

This winter has also seen the launch of newly appointed government agreements, with specific policies dedicated to the decarbonisation of industry. Notably, that of the new German Coalition, whose recent proposals include carbon contracts for difference under their Climate Emergency Programme. The aim is to advance the market introduction of climate-friendly processes by cushioning the cost differences and risks (compared to proven climate-damaging technologies). Separately, the new Dutch Coalition has announced it will enter into binding and tailor-made agreements with the 10 to 20 largest industrial greenhouse gas emitters in the Netherlands.

Meeting these European and national commitments will require innovation and collaboration between industrial players and energy companies. The decarbonisation of process heat is a particular challenge. Options, such as generating heat directly from renewable electricity or delivering it via hydrogen, infrared radiation, microwaves, or superhot gaseous plasmas, are starting to be developed. In Sweden, HYBRIT (SSAB, LKAB and Vattenfall) has successfully used hydrogen made from hydroelectricity to turn local ore into CO<sub>2</sub>-free steel which the car manufacturer, Volvo, plans to use for truck parts. Global cement giant Cemex and ETH Zurich spinoff, Synhelion, are building a solar-heated pilot cement kiln to power the energy intensive cement production process and capture 100% of the carbon emissions released, whilst HyCC (Nobian and Macquarie's Green Investment Group JV) aims to produce green hydrogen from renewable power at an industrial scale.

Policies are also aimed at bringing about brave steps in the domestic sector. The UK's Net Zero Strategy, Build Back Greener includes the rebalancing of policy costs from electricity bills to gas bills and the launch of a Hydrogen Village trial, the H100 Fife project. This involves a hydrogen network on the east coast of Scotland that will bring renewable hydrogen into homes in 2023, providing zero-carbon fuel for heating and cooking. Separately, Cadent and Equinor plan to develop a Hydrogen Town concept in Lincolnshire, England. Elsewhere in Europe, a recent change in the structure of regulated grid connection charges, regional reductions in property tax, and contributions from the Next Generation EU fund has led to the rise of distributed solar PV in Spain, totalling 2.5GW in just three years.

Despite the current setbacks of some smaller energy suppliers going out of business, increasing availability and usability of data generated by digitalisation is leading to the creation of new products and services. The rise of smart home technology, the rapid adoption of EVs, increasing

volumes of micro-generation and the decarbonisation of heat, means a shift away from relationships based simply on kilowatts supplied and a move towards service-based models based, for example, on the number of warm hours, or miles of electric transport.

Digitalisation and the shift from centralised unidirectional to distributed energy systems is also driving the development of microgrids. Although the adoption of microgrids in the US has largely been in response to power outages, they are starting to appear in (mainland) Europe. A barrier to their success, however, is that most grid infrastructure is based on alternating current (AC). Conversely, renewables, which microgrids often use as their power source, generate a direct current (DC) output whilst most modern electrical equipment such as laptops, mobile phones and LED lighting operate on DC. To bridge this gap, the Horizon 2020 supported project TIGON, is developing a modular concept of a DC-based hybrid grid. The technology will first be tested at two demonstration sites, before being tested on a commercial scale in a residential sector in Naantali, Finland and separately, on a metro DC grid in Sofia, Bulgaria. Tackling some of the technical barriers for microgrids will also bring about benefits for the growth in Renewable Energy Communities (RECs). This is one of the aims of the Renewable Energy Directive II (RED II), as it is recognised that citizens who produce their own energy are more concerned with reducing their electricity consumption.

Brave steps to decarbonise are not just limited to endusers and generators. TSOs and DSOs are also energy transition enablers through their role in integrating renewable generation and flexibility resources into the energy system and supporting the direct and indirect electrification of different sectors of the economy. However, they are also investigating ways to reduce and limit their direct emissions. Swissgrid is running a pilot to assess the feasibility of replacing diesel-powered uninterruptible power supply (UPS) with a hydrogen powered fuel cell, whilst TenneT and APG are testing alternatives to the use of sulphur hexafluoride (SF<sub>6</sub>), an inert gas widely used in circuit breakers that has a high global warming potential.

Given the continuance of the high energy price world, politicians will need to be "brave" to pass through this moment to avoid the commitments made at COP26 to become fragilized. This will allow for pilot schemes taking place now, to flourish and lead to mainstream solutions. On the other hand, once we are used to expensive fossil energy then the cost of decarbonisation pales by comparison. This year might just be the push for society to take a brave step and get action quicker – whilst recognising we have to protect the most vulnerable in the short term.



Interview  
Anna König Jerlmyr  
Mayor of Stockholm



# High ambitions

A European capital that is fossil-free and climate-neutral by 2040? All inner city traffic emission-free by 2030? For Stockholm's mayor, this is no utopia but rather part of a plan to make the city greener and more liveable.

**You believe a city needs a strong identity as well as a purpose to be attractive to people and companies. Why is this important?**

I am proud to be the mayor of Stockholm, which has a reputation of being a forward-thinking city with high living standards and an ongoing important work with gender equality, clean energy and improving accessibility. Stockholm has a strong identity and purpose that draws both people and businesses to the city. It is a city of opportunities for the people living here and for the companies.

The people of Stockholm want to make an impact and be a part of this ongoing work. Therefore, the city must deliver these opportunities of involvement and impact. We can also see a change in priorities, especially among young people, when they face choices such as a new workplace or which city to live in. They ask themselves, what is my purpose and what do I want to leave behind? Another observation is that workers increasingly choose where in the world they want to live, before choosing which company they want to work for. Therefore, it is a priority for me that Stockholm operates according to the values of openness, transparency and freedom. I believe that Stockholm's collaborative environment and open mindset have helped it attract and retain talent.

So, compared to before, we tend to prioritise involvement with companies and projects that have a sense of purpose instead of only the

salary. Therefore, it is also important to create an open environment where companies and people can be creative and flourish, and feel belonging to the city during the process of development. For these reasons, I want to continue building a city of opportunities for our citizens.

**Stockholm is investing heavily in its infrastructure – metro, highway and even the city's power supply is being upgraded. How does this lead the city becoming not only climate neutral but even climate positive faster than others? Do you have a sustainability master plan?**

Of course, metro expansion plays an important role in reducing emissions in the future. I am very happy and proud that we have such a large expansion of the metro and that more are planned in the future. But there is also much more a city can do to reduce emissions and enable cleaner air for residents.

Since 1990, the time when we started measuring emissions in the city, we have managed to reduce emissions in absolute terms by 50% and per capita by 65%. We are now further intensifying our climate work and aim to be fossil-free and climate-neutral by 2040, and all traffic in Stockholm's inner city will be emission-free by 2030. An important prerequisite for achieving our high goals is electrification of the vehicle fleet. Therefore, we have now made a historic investment in charging infrastructure in the city of Stockholm – by 2030, all parking

spaces in the inner city, (owned by the city) will be equipped with charging options and for the suburbs, 80% of the city's parking spaces will be equipped with charging options.

We are also phasing out fossil fuels in the city's procurements of transports and work machines. In addition, we have also initiated a collaboration with the business community, a project we call the electrification pact, with the goal of speeding up electrification and solving difficult challenges such as lack of electricity capacity and charging of heavy traffic.

Through our energy company Stockholm Exergi, we also carry out several important projects in line with our climate ambitions. One of these projects is a facility for CO<sub>2</sub> removal through bio-CCS. This technology involves capturing and storing CO<sub>2</sub> emissions from the combustion of biofuels from our combined heat and power plant that produces electricity and heat. Stockholm Exergi's calculations show that there is potential to capture 800,000 tonnes of carbon dioxide per year. The goal is a full-scale facility by 2025.

**Digitalisation increasingly determines our normal everyday life. What new digital solutions have you seen in recent years that have proved the most promising to you in terms of supporting modern city life?**

The City of Stockholm is continuously transforming by new digital solutions that support our modern city life. To do this in the best way I truly believe

in close collaboration with both the research and business community, locally and internationally. One of our ongoing projects is a collaboration with academia and industry where we focus on urban planning and development. The project, named Senseable Stockholm Lab, explores how artificial intelligence, big data, and new sensor technologies can help Stockholm evolve into a more liveable and sustainable city.

The starting point for the research is to use digitalisation as a tool to map out the urban environment and better learn how people and companies “use” Stockholm. The project covers areas such as energy production and efficiency, environmental monitoring, water and waste management, and more.

The city of Stockholm is looking to lead the way as a global role model for the green transition. Throughout the collaboration, we have identified development areas and come up with solutions that can help us in supporting this modern city life. One of the projects was focused on urban segregation and inequalities where we investigated how the citizens of Stockholm meet during the day while traveling across the city. By doing this, the results can be used to plan for a more cohesive city.

Another project is the Stockholm Sensing Platform where a multisensory platform was designed and tested to collect various environmental data from the street space. The goal was to implement, test, and evaluate the possibilities for the lab and then for the city, to collect hyperlocal data from the street space in Stockholm with simple sensors. Through the data that we collect from the sensors, we can measure air quality, temperature, humidity and noise. The results in the form of knowledge and methodology from the project will be important as a basis for urban planning at several different levels and for the climate adaptation investments needed to achieve a good living environment in the city. Digitalisation is with us every day and we elaborate new solutions frequently through the city's collaboration with academia and industry that I am very proud of.

**This edition revolves around brave steps and action in the transition to clean energy. What action have you seen in Stockholm with regard to the energy transition?**

Several important steps have been taken in Stockholm for the energy transition. For example, district heating production's emissions have fallen sharply thanks to the phasing out of coal and fossil oil and in 2020 our energy company closed the last coal boiler.

Also, Stockholm's CHP plant produces heat and electricity from renewable biofuel, which is very climate-friendly, and from household waste. In order to reduce emissions when it comes to combustion of waste, we have set up an automated sorting facility that will sort out the plastic from the waste. Thanks to our district heating system, we can also use surplus energy from nearby industries and recycle it to warm up Stockholm's households.

**Every city has its own preconditions, geographically, economically or technologically. How important do you consider the social factor to be and how does this guide your work?**

As you mention every city has its own preconditions and the social factor is very important. Today social sustainability in the City of Stockholm is developing in a positive direction. Stockholm is well placed in a global comparison with a high living standard and an expanded welfare system. Life expectancy increases in an equal, well-educated population with a high turnout. Compared to other major European cities, for example, Stockholm has a high employment rate and low relative-poverty rate. These are very important basic conditions in the city's work. Differences in living conditions affect peoples' health and well-being, hence the city's attractiveness.

In my everyday work, I always bear with me the importance of the social factor. For instance, everyone should feel safe in their city. To achieve and maintain that we need to plan our city so that it offers a variety of activities and performs different

functions that reflect the needs of the population living here. That is different in every city and here it is important for me that we work closely with the citizens and businesses to achieve the best results.

One way of doing this is by adopting feminist urban planning. The theory by Jane Jacobs, which I was inspired by, is about making urban spaces safe for women and children in order to make them become safe for everyone. You need to feel welcome when you come to a public space. Important elements to achieve this are good lighting and cleanliness. By including women more in urban planning, we can create safer urban spaces and this is a benefit for everyone.

**At AFRY, we talk about Making Future. What are your main priorities for the next 10 years?**

Stockholm is at the forefront when it comes to technology development in the climate area. We have high ambitions and allocate resources to reduce emissions and create a more sustainable society. Stockholm has pursued an effective and results-oriented climate policy, where we have been concerned that all money invested in the climate will yield results. We have also succeeded in combining economic growth with reduced emissions, which I believe is an absolutely crucial part if we are to succeed in the future as well.

The question of future priorities in the climate for the 10 years to come must of course be affirmed in the light of technological and societal developments. But as it looks today, I think we need to focus on four priorities when it comes to cities perspectives.

To succeed in the green transition in cities, we first need to reduce emissions by electrifying the vehicle fleet, phasing out fossil fuels, enabling the electrification of heavy trucks and strengthening electricity capacity. We also need to acknowledge and be open to new technologies and solutions for the climate.

Secondly, we need to recycle more, for example we could recycle building materials. Today, large amounts of building parts that could be reused



in rebuilding and new construction are thrown away instead of being used to their full potential. We should also invest more in district heating, in this way we have the opportunity to recycle heat that would otherwise have been wasted, for example from nearby industry. Through district heating systems, we can also transport locally produced electricity from combined heat and power plants, which can have significant effects, especially now when there is a lack of capacity in the power grids.

Thirdly, we need to capture and store emissions. Stockholm's energy company is doing this on a trial basis through BIO-CCS and it has the potential to capture 800,000 tonnes of carbon dioxide. Fourthly, we need to adapt the climate to the city through various measures, for example we need to be able to capture large amounts of water to reduce the risk of flooding or provide for heat waves.

### **Why should people choose Stockholm as their new home city?**

The City of Stockholm is the city of opportunities. In our city, we have amazing creative people from different countries and cultures that drive the development. Stockholm is unique and a city of balance. A balance between the city and nature as well as work-life balance, which makes it an attractive city to raise a family and build a career.

In recent years, Stockholm has earned the reputation of being an “unicorn factory” and Stockholm strives to have Sweden's best business climate in 2025. A healthy business climate in combination with an open and welcoming atmosphere where diversity and innovation are encouraged. I would say that Stockholm gives its citizens a high quality of life.

Stockholm is growing and, in line with that, the city has adopted a unique approach to sustainability where every aspect of environmental, economic and social impact is part of the equation. My continued vision is for our city to be the most attractive city with high living standards. Therefore, I can proudly recommend people to choose Stockholm as their new home city.



# Together

## **Corporate survival: an uphill battle?**

Covid-19 was the issue of the year until the invasion of Ukraine by Russia. Despite the terrible situation facing Ukraine, it is still true that climate change and sustainability are the issues of the century. Devising a vaccine for Covid-19 took 12 months – no small feat – yet the climate challenge will span into the next century and, make no mistake, it will entail gargantuan amounts of effort and a worldwide clasping of hands.

As the world advances towards looming deadlines around environmental targets, the corporate squadron is undergoing major changes, making thumping climate commitments and striving to improve its influential role in society. According to Natural Capital Partners, 38% of Fortune Global 500 companies have made a public climate commitment by 2030. When you are a company that has been around for over a century (AFRY's roots date back to 1895), and still expect to exist for the next 100 years, you soon realise that you must change the way you do business with one key thing in mind: moving from limitless waste and rampant

consumerism as the bedrock of traditional business, to a new reality where decoupling growth from carbon intensity in business is the number one priority.

When situations lack analogies to the past, it is hard to envision the future. Jonas Gustavsson, AFRY's CEO, went a step further at COP26 upholding that "if you think too much on the past, you will not know what to do moving forward". Towards making future, a fundamental stronghold for the corporate squadron are the young cadets. While, previously, traditional businesses flaunted short-term goals, the ever-shifting territory is impelling companies to take action through the lens of long-term planning, which should gravitate towards incorporating the youth's perspective as, by the target year, millennial recruits will be the ones at the forefront of decision-making. Preparing and involving them early on is the way to go.

## **Youth to the barricades**

We stand on the brink of the 4th Industrial Revolution. In the words

of Lucas Joppa, Microsoft's Chief Environmental Officer, in the past three revolutions we have been borrowing from the future to pay for the present. With the risk of being falsely adjudged as tech-bashers, we [the youth] want to become the first revolution to stop this scrounging cycle. To the benefit of corporate diversity, there are particular characteristics of today's youth that differ from previous generations, and serve as a firm hand to steer through the windings of the next decades. Adding to the corporate blend, the young generation can generally be described as purpose-driven and future-focused, with the desire to have a societal impact, and very importantly, they are technology-oriented.

## **Societal and environmental impact through business**

The first thing to understand is the profound motivation of today's youth to improve the prospects for the future. The environmental challenge has been entrenched in today's youth since the beginning of their studies, which has resulted in an unfeigned concern for this issue. It seems, however, that while the youth is very much at the frontline in brazenly voicing their concerns in the





streets, they are absent in providing a fresh perspective in their office's conference room. It is important for the more experienced to bridge these gaps in communication, particularly with regards to sustainability, acknowledging that (1) today's youth is not stirred by the current raft of bombastic carbon targets which are already starting to sound like humdrum, (2) they have a zeal for social impact, and (3) engaging with young people should mean adapting towards a new business-as-usual, becoming more visual, interactive and flexible. According to Deloitte Millennials Impact Report, 82% of millennials whose current organisation's values align with their own, stay with the company for more than five years. Companies can combat staff turnover and retain talent by remaining true to their alleged values.

There are two ways companies ought to embrace sustainability.

- Internal transformation, i.e. their own operations, their spaces and people. Coupled with this intent, promoting the youth to be part of the sustainability discussion has never been more valuable and can be a first step for a deluge of idea-creation pouring across teams should the right channels be enabled;
- External transformation, i.e. the impact on society through client projects and communal activities. This transformation can be bolstered by giving the

youth the opportunity to ideate solutions and actions, to be trained in strategic foresight and in critical business thinking early on, honing in on corporate responsibilities according to all faces of sustainability, i.e. carbon, waste, water and biodiversity, as well as societal welfare.

#### Technology: our greatest ally

The youth's lives are, by and large, latched onto technology. We are talking about a generation that shops with their phones and talks to home appliances. In other words, a marriage between sustainability and a digitalised and interconnected future is bound to chime, playing a birthing role in the transition's underpinnings. This reality has opened pathways that the corporate garrison is already taking on. An inflexible and play-safe corporate stance repels young talent; it would be a recipe for corporate suicide. This is where the youth, with their ideas and precocious tech-talent can propel solutions forward. Engaging with the youth accelerates adoption of digital technologies without demur. The figure below evinces that greater youth employment correlates to higher digital adoption.

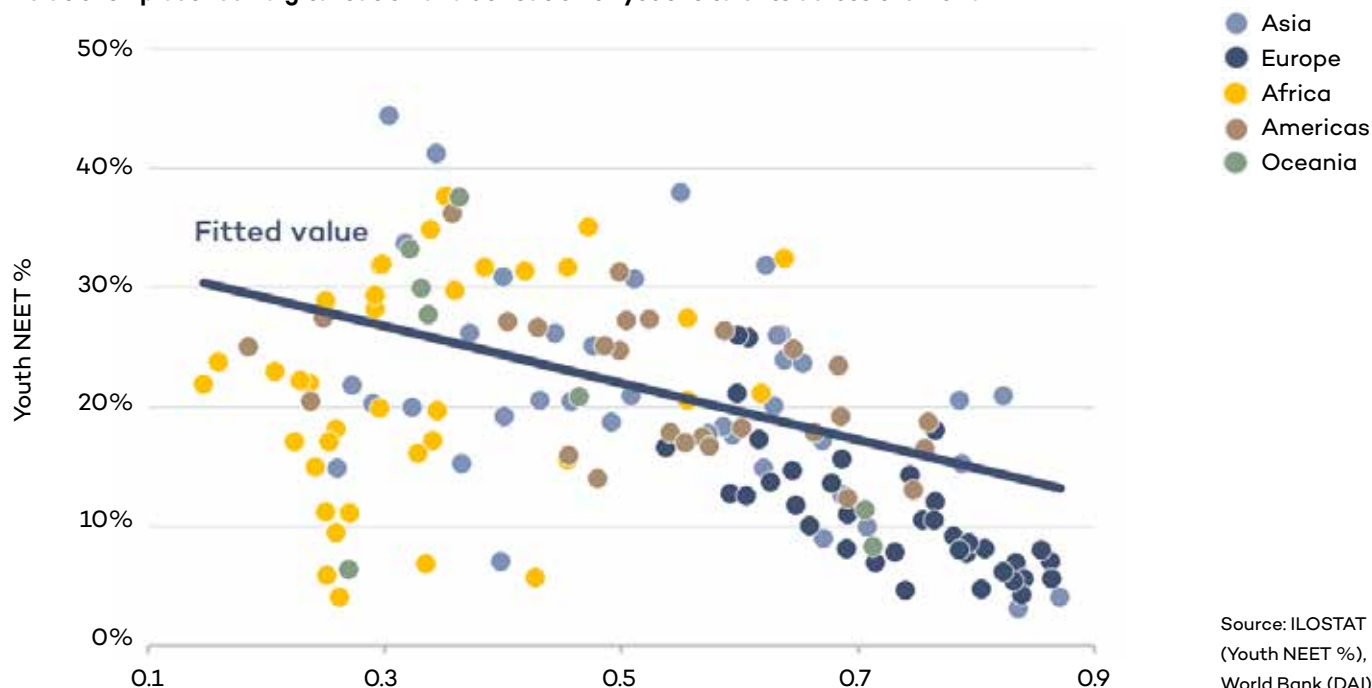
The youth feels that we need to go far beyond advocacy and corporate branding. The tenet of success is to start early with real actions. To that end, frontline young troops need to

develop a sense of self-confidence and understanding of what they can bring to the table; the veterans should encourage them to raise their voices, teaching them not what to think about the future, but how to think about the future. Traditional corporate business-as-usual should work hand in hand with this perspective to achieve 'great', and this can only be conquered through diversity and innovation, as they impact every single thing that we do. None of our skills individually are enough, but every single one ought to be brought to bear.

To companies' advantage, the youth is a powerful engine staring at their face to create raw brilliance. We need always remember that the youth brings an eclectic mix of entrepreneurial minds and the broader this mix is, the better. While it seems the global environmental clout is focused in Europe, we should not flinch over whether to explore or not the perspective of a young employee in Brazil living close to the climate threats. Failing to consult them impairs us from real insight and change.

The greatest triumph would be to hoist the victory flag in some decades' time thanks to a cross-generational collaboration. We wanted purpose, there we have it, to reify humanity's greatest strength: one another.

Relationship between digitalisation and utilisation of youth's talents across the world





Interview

Jonas Gustavsson

CEO at AFRY

# Welcome just as you are

With inclusion and diversity at the top of AFRY's strategy, we wanted to find out more about CEO Jonas Gustavsson's plans and why he considers inclusion and diversity to be prerequisites for AFRY as company.

**In this edition of AFRY Insights, we are focusing on brave steps and action in the transition towards a future sustainable energy industry. Within that context and thinking of the future of work, what brave steps are you taking in the inclusion and diversity space at AFRY and why is progress there important to your mission Making future?**

Like the transition to clean energy, inclusion and diversity is about a transition towards a more sustainable future. This is why we have made inclusion and diversity central to our culture at AFRY and part of our strategy and sustainability targets. In order to set clear direction and ensure that we take action, one particular brave step we've taken is to target 40% female leaders by 2030. A target such as this needs commitment from executive management and is a promise to the organisation as well as investors, giving us a common agenda and focus to secure our progress going forward.

There are a number good initiatives taking place at AFRY that support this target, such as the Accelerated Female Development Programme within our Energy business, which focuses on the development of our female colleagues as leaders. Concrete steps to increase diversity are generally brave as they challenge the status quo.

Since 2016, we have been running Immigrated Competence, a programme aiming to attract and recruit foreign-born engineers. The programme was initiated in Sweden after the war in Syria broke out in 2015 and

many were forced to flee their country. Our substantial need for recruitment was a major factor in starting the project and almost 600 colleagues have joined AFRY through the programme since it was launched. Now, following Russia's invasion of Ukraine, we are facing a new large wave of refugees, as people are forced to leave their home country. We believe that a good way towards integration for newcomers is to put skills to use as employee in a company, and to feel needed and included in the new country. People from the programme often bring new creative ideas and dynamics to the workplace. They open new ways of discussing and solving problems, so the diversity creates engagement and harmony.

**What challenges can you foresee to reach AFRY's target of 40% female leaders by 2030 and what's your advice to companies who are trying to support similar targets?**

It is a challenging target, both in terms of our starting point and in terms of more local structural hindrances like educational opportunities and parental leave regulations. A general lack of the competences we are looking for, a competitive market and a shortage of female candidates are true challenges for us. Our task is to retain our current female colleagues and leaders and make use of our potential to develop more female leaders internally, in addition to recruiting externally. We have to do this and achieve at least 2 percentage points' progress each year.



It is difficult to give advice that changes the situation overnight. We are taking small steps in the right direction and this is long-term work, but our common strategic target gives focus and attention – a stretch gives a sense of urgency, forcing structured work to identify concrete brave actions and proactive planning. The 2030 target provides us with good momentum to make change, as it's a concrete aim and there is a long way to go to get there. It's this challenge that makes the opportunity.

In general for inclusion and diversity, perhaps the biggest hurdle (and therefore the biggest opportunity) is getting the message through that people need to challenge themselves and their usual way of doing things and be self-aware about their own biases.

What we are currently doing at AFRY to support that, is building in inclusion into our processes and working with preparing our workforce and leaders to become more inclusive, through, for example, unconscious bias training. At the end of the day, if you don't follow new approaches, then you don't see any shift in the results and therefore in the diversity at the company. There is so much to done in this space for AFRY and across the business community and so our list is very long of things we can work on.

**It is proven that inclusion and diversity are good for business. How would you advocate for inclusion and diversity with others in the business community who do not understand it's importance?**

Progress within inclusion and diversity creates a competitive advantage as it safeguards competence, innovation, and growth. We see this as crucial at AFRY, to be able to stay relevant as an attractive employer and business partner and to stay at the forefront within our industries. We have a strong belief that inclusive and diverse teams, with deep sector knowledge, achieve better results, and are more competitive, creative, and profitable. We're convinced that this will enable us to accelerate the transition towards a more sustainable society, while also ensuring that there are role models for future generations.

Within the business community there is simply so much more innovation when there is diversity and when people feel included. This is something we can track and measure, in terms of development, retention, work environment and sense of belonging. Having expertise within a company that reflects the diversity of society as

a whole provides new perspectives and helps to develop innovative solutions. The world is complex and it's important to ensure that the bigger picture is taken into account when making decisions.

Inclusion and diversity are commercially and financially advantageous for companies and therefore quite simply more profitable. It will become difficult for companies to attract and retain the best talents without working actively towards diversity and inclusion. When it comes to inclusion and diversity, every word, every situation, every effort counts.

**There is still a long way to go in going beyond the theory into building an organisation that fosters intersectional diversity and inclusion. What do you see as the next obstacles for the business community at large to overcome?**

Three significant obstacles that we face are: Educating the senior leaders who may be from another generation. Breaking stereotypes and unconscious. And getting people onboard and inspiring them to learn more.

In order to actually make the shift, it's really important for the existing business leaders to support this process towards inclusion and diversity and be allies towards minorities. Everybody needs to be included in the change – men, women, nonbinary – and the men have an important role, since they are often the majority. We need great men empowering those who are less represented to shift the balance and there needs to be representation and diverse role models at all seniority levels.

We have had a lot of discussion related to the gender diversity target and one big challenge is how to translate the targets into the goals of the individual managers and how to measure that. This is one aspect that we have addressed this year and I'm looking forward to seeing the results and finding out how we can support that shift towards the right kind of behaviour.

There is a long way to go and I hope that with inclusion and diversity at the heart of AFRY, along with our work being aligned with the discrimination laws and grounds (sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age), we will be able to continue making meaningful progress. AFRY is nothing without its people. We have colleagues all over the world and we will always encourage them to be themselves.

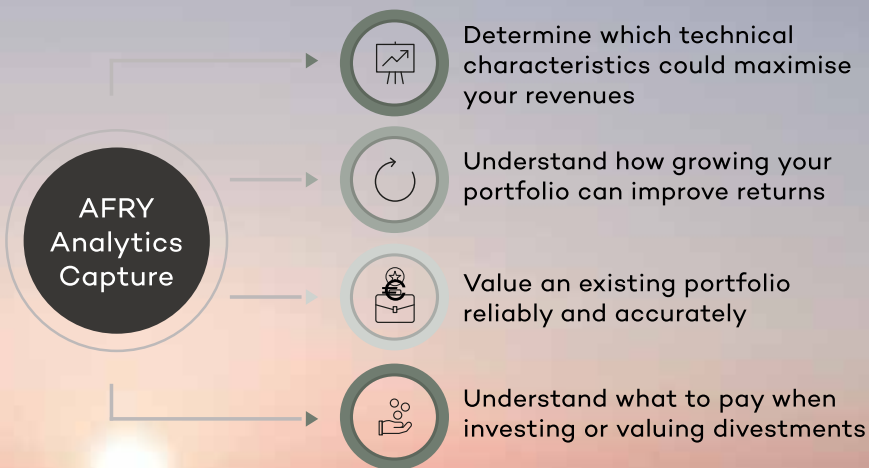


# AFRY Analytics Capture

Digital solution calculating capture price projections in a second for any renewable asset – worldwide.

AFRY Analytics Capture allows you to capture the value of solar and wind farms in any market across the world. It has been designed to be accessible and user friendly, providing you with an accurate view of future revenues and asset-specific capture price projections in a matter of seconds. Understand not only which sites maximise output but also maximise revenue. With asset-specific wind capture prices varying from market values, AFRY Analytics lets you discover opportunities that otherwise would have been missed using market-wide capture prices.

AFRY Analytics Capture lets you:



For more information, visit the web page posted on our AIMR Portal and get in touch if interested in a demo or a free trial of the tool.



# Carbon Removal Technologies

A \$10 billion carbon credit market by 2030

Intergovernmental Panel on Climate Change (IPCC): to avoid a future of catastrophic climate disasters, global warming must be limited to 1.5°C.

One way to limit global warming:  
Carbon removal technologies and  
a robust market for removal credits.

## Avoided emissions vs carbon removal

Avoided emissions and carbon removal  
are fundamentally different.

### Avoided emissions

One metric ton of CO<sub>2</sub> is reduced or avoided for every metric ton of CO<sub>2</sub> emitted. This still leads to a positive increase in emissions overall.

Examples



Renewable energy



Avoided deforestation

### Carbon removal

One metric ton of CO<sub>2</sub> is removed and stored completely  
from the atmosphere for every metric ton of CO<sub>2</sub> emitted.

Examples



Reforestation/  
afforestation



Biochar



Direct Air Capture  
with Carbon Storage



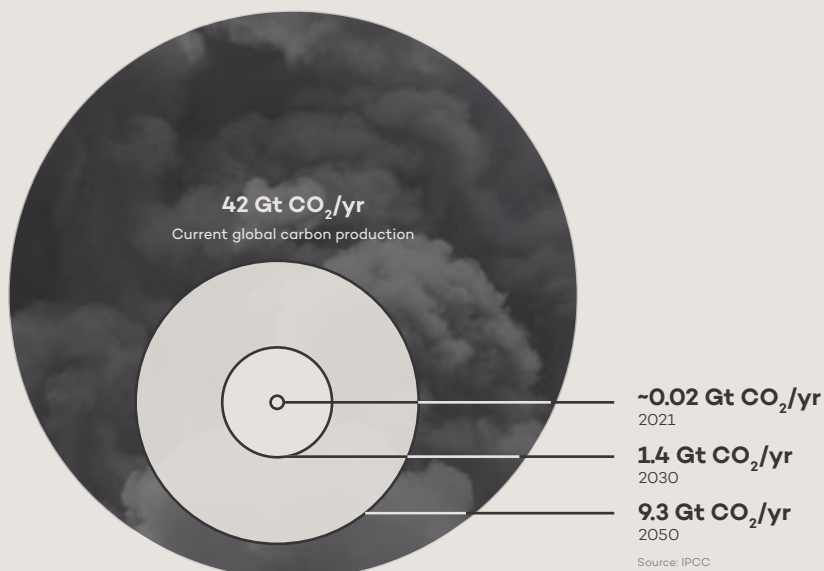
Carbon removals have a distinct advantage over avoided emissions because they take emissions out of the atmosphere.

They are essential to **stabilise atmospheric concentrations of CO<sub>2</sub>** and thus global temperatures.

### IPCC 1.5°C Path to Net-Zero Emissions

To keep on a 1.5°C pathway, current emissions must drop by 50% by 2030, and reach net-zero by 2050.

Carbon removal needed by year  
to maintain the 1.5°C pathways:





Carbon removal is an essential part of the transition to net-zero carbon emissions.

## Carbon removal technologies include:



### Soil carbon sequestration

Changing agricultural practices such as tillage or crop rotations to increase the soil carbon content.



### Habitat restoration

The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Habitat restoration can also help make ecosystems more resilient to extreme climate events.



### Reforestation/afforestation

The establishment of forest on land.



### Carbon negative concrete

Replacing cement in the concrete mix with steel slag and injecting the wet concrete with carbon dioxide to cure it, giving it its strength.



### Biochar

Charcoal produced by pyrolysis of biomass in the absence of oxygen; it is used as a soil amendment.



### Biomaterials

Using biomaterials, like wooden buildings, increases the time of carbon storage from natural biomass.



### Enhanced weathering

A set of theoretical proposals to remove CO<sub>2</sub> by spreading large quantities of selected and finely ground rock material onto extensive land areas, beaches or the sea surface.



### DACCS Direct Air Capture with Carbon Storage

A technology that uses chemical processes to capture and separate CO<sub>2</sub> directly from ambient air so that it can be injected into geological reservoirs.



### BECCS Bioenergy with Carbon Capture and Storage

The process of capturing CO<sub>2</sub> in biomass and storing the carbon in geological reservoirs.





## Interview

Katherina Reiche

CEO of Westenergie and chairwoman of  
the German National Hydrogen Council

# Inevitable

She is one of the leading managers shaping the energy world of tomorrow. For Katherina Reiche, CEO of Westenergie, hydrogen is the defining energy vector of the future. In our interview, she talks about the impact of the Russian invasion of Ukraine on the energy sector, tells us how hydrogen will define the energy world of tomorrow and describes how companies can successfully position themselves today for a sustainable and climate-neutral future.

**Ms Reiche, we originally just wanted to discuss the topic of hydrogen with you in this interview. The war in Ukraine, however, does not only dominate headlines and the political agenda, but has also a significant impact on the energy industry. What does the conflict mean for supply security and what for the future energy supply in Europe?**

The terrible and completely unjustified invasion of Ukraine by Russia has produced incredible suffering and pain for millions of people. Our hearts go out to those affected by this unforgivable aggression, and it is they who are on top of our minds. But you are right: This war is also a turning point for European energy supply and thus for the energy industry. For us at Westenergie, this is first and foremost a time in which the primacy of politics applies. We are following the lead of the Federal Government and the European Union and look at them to define the necessary steps to be taken throughout the industry in the short and mid term.

Looking at the bigger picture, it is probably safe to say that Putin's invasion has increased the urgency, but also the difficulty of driving security of supply, climate protection and competitiveness forward – while keeping all these factors in balance.

Now three steps are crucial: Firstly, we need to diversify the gas supply and especially minimise our dependency

on gas from Russia. We need to do that very level-headedly: Gaseous energy carriers will continue to be indispensable as mainstay of our energy supply system in the future – natural gas in the short and medium term, hydrogen in the long term.

Secondly, we have to massively expand renewable energy production and synchronise this with the expansion of the grid. And finally, we must ramp up the hydrogen economy with new urgency. Green molecules are the key to redesign our energy system to be both sustainable and resilient to crises. It is therefore commendable that the Federal Government and the European Union are taking these steps.

**You are the chairwoman of the National Hydrogen Council, which advises the German government. Why do you believe in hydrogen as a key enabler for the energy transition and what is the council doing on a practical level to enable hydrogen to play its role as an energy vector?**

Hydrogen will be a fundamental and indispensable pillar of our energy system – especially with the new challenges resulting from the Russian invasion of Ukraine. It is the perfect addendum to renewables, as hydrogen allows us to store electricity over a long period without great energy loss. So that when renewable energies cannot fully supply our energy demand, we convert hydrogen

## Hydrogen will be the energy source of the future – but the future is developing at breathtaking speed.

to energy. Beyond that, hydrogen is the only efficient decarbonisation option in sectors where electrification is neither possible nor economically feasible. In a nutshell: hydrogen is a must-have.

In order for hydrogen to fulfil this role in the near future, the National Hydrogen Council was established in 2020. We are advising the Federal Government, but also act as a mediator between political actors, academia, CSOs, and industry, and as a driver for hydrogen generally. We have, for example, conducted a meta-study on hydrogen. It summarises all current research into hydrogen in Germany and allows us to give a precise overview of anticipated minimum, maximum and most probable national hydrogen demand. We have also submitted our recommendations on current legislative proposals regarding the implementation of the National Hydrogen Strategy and the ramp-up of a hydrogen economy. And we have made recommendations on how to implement and further develop the National Hydrogen Strategy itself. Last year we published the Hydrogen Action Plan, which proposes 80 measures on how to further develop the strategy – some of which have already been taken up by the new government.

### **What time horizon are you thinking of when you talk about hydrogen as the energy source of the future and in which sectors do you see it being deployed before 2030?**

As I said: Russia's invasion of Ukraine is a turning point. And it will be an accelerator for the hydrogen economy. The fact is: Hydrogen will be the energy source of the future – and the future is developing at breathtaking speed. The German government just recently doubled its ambitions for the national electrolysis capacity in 2030 from five to ten gigawatts. We see hydrogen buses and refuse collection vehicles appearing on the roads.

Of course, it will still take a few years before hydrogen is widely used. This will require a comprehensive hydrogen infrastructure and the availability of large quantities of climate-neutral hydrogen on the market. A recent study by the Federation of German Industries (BDI) expects Germany to have a hydrogen and Power-to-Liquid (PtL) demand of 110 terawatt hours in 2030. I am convinced that we will see hydrogen in all sectors by 2030 – and not just a few selected ones. The potential for GHG reductions is too significant and the need for action on climate change too urgent for us not to seize this opportunity.

For example, hydrogen can play a key role in the decarbonisation of the heating market. In Germany, 51% of all flats were built before 1970. For technical reasons, electric heat pumps will hardly become a comprehensive heating option in these existing buildings in the short term. Climate-neutral hydrogen distributed through the

existing gas infrastructure is a fast and cost-effective decarbonisation option for such buildings. We must seize such opportunities and not limit them by restricting hydrogen to individual sectors.

### **In the H2.Ruhr project you are working with Enel and Iberdrola to build a hydrogen value chain both on your own doorstep and yet across European borders. Can you reflect a little for our readers on the project background and its goals?**

H2.Ruhr is a project developed by E.ON and Westenergie to jointly build-up a cross-border European green hydrogen value chain. The project initially foresees the delivery of up to 80,000 tonnes of green hydrogen and green ammonia per year in the Ruhr region and from there to our gas distribution network. Around 3,900 industrial customers are connected to our grid, accounting for about 40 per cent of the withdrawal volumes. Compared to the national average of 16 per cent, this illustrates the high industrial density in the region. If the corresponding gas quantities were replaced by hydrogen, up to 2 million tonnes of CO<sub>2</sub> could be saved per year.

E.ON plans to start construction for a 20 MW electrolysis plant in the Ruhr region by 2025 as the project's first step. Enel will supply this electrolyser with green electricity from wind and solar energy from Italy. In parallel, Iberdrola will set up its own hydrogen production in Spain and transport green hydrogen in the form of ammonia by ship to Germany. H2.Ruhr also includes the construction of a regional hydrogen pipeline infrastructure with a direct connection to a broad spectrum of consumers in the Ruhr area.

This project is unique as it is the first example of such an integrated, pan-European project. It will test new innovative technologies at scale, such as the ammonia cracking technology, electrolysis, emission-free transport (via hydrogen or ammonia powered vessels or trucks), as well as the long-distance transport of electricity dedicated for hydrogen production.

### **The hydrogen policy for Germany seems to rely heavily on hydrogen imports rather than attempting to become self-sufficient. Can you explain why this is? And what measures Germany is putting in place to secure hydrogen imports from outside the EU?**

Germany has always had an enormous energy demand due to its size and strong industrial sector. We have been a net importer of energy for a long time and our dependency on external energy suppliers won't end in a carbon-neutral future. In 2020, we imported around 71 % of our energy. We assume that in 2030 we will need to import at least 40% of our hydrogen, and in 2050 it will be as much as 60%.



A good example for Germany's massive hydrogen demand is the country's largest steel plant, owned by thyssenkrupp in Duisburg. To operate this one plant in a climate-neutral way, thyssenkrupp needs 720,000 tonnes of hydrogen per year. To produce this amount of hydrogen, green electricity from about 3,800 wind turbines is needed. If all steel production in Germany would be converted to hydrogen, this alone would require the amount of electricity from 12,000 additional wind turbines of the large five-megawatt class.

We cannot meet such an energy demand domestically. Here, climate and development partnerships should strengthen multilateral cooperation. There are plans to form an international "climate club" with a uniform minimum CO<sub>2</sub> price, as well as a global emissions trading system with a uniform CO<sub>2</sub> price in the medium term. All this highlights how important European and international aspects are to the hydrogen economy. And it shows why the Russian war against Ukraine has made it even more urgent for Germany and the EU to speed up hydrogen imports.

**Doing business sustainably can mean deciding against more successful short term solutions. What advice do you have for players in the energy industry, from utilities to policymakers, on how best to articulate the short term challenges relative to the long term benefits?**

Let me speak for Westenergie. We try to act responsibly and sustainably – for our employees and the environment. Short term gains can be very tempting, especially as many decision-makers are often measured by short term goals. However, a manager or politician who approaches his duties with social responsibility and foresight knows that such behaviour will not lead to success in the medium or long term. It is clear that with a rising CO<sub>2</sub> price, a fast growing availability of renewable energies and a massive increase in electrolyser capacity, green technologies will become the cheaper option in the medium term. A climate-neutral world is just as inevitable as the large-scale use of hydrogen.

A climate-neutral world is just as inevitable as the large-scale use of hydrogen.





# Path to net-zero

Technologies for a climate-neutral industry are already available now. Green hydrogen plays a central role in both the steel and chemical industries. In the chemical industry in particular, closing material cycles (circular economy) is also a central strategy. Whereas carbon capture storage and new binders are key technologies in the cement industry.

Materials and products produced by heavy-industry sectors such as steel, cement and chemicals are central to our lives and are expected to continue to play a key role in a net-zero economy. For example, steel is going to be required for wind turbines while plastic will be necessary to produce solar panels and electric vehicle components. Concrete will be critical to meeting the future infrastructure needs of our economy, from roads to buildings and industrial structures. The change required to achieve full decarbonisation of these sectors will be radical.

Historically commercial players have embarked on emission-reduction programmes to respond to regulatory pressure or take advantage of short-term incentives. More recently, we are seeing an increasing number of businesses – across different sectors

– announcing net-zero pledges and roadmaps or strategies to achieve them. These initiatives have partly been driven by the growing pressure from investors, communities, customers, and employees to adopt sustainable strategies. Some – the first movers – are seeing the energy transition as an opportunity to develop a long-term competitive advantage and capitalise on this shift. Pressure has been building up on heavy industry players – which have traditionally been seen as too hard to decarbonise and continue to lag behind in terms of emissions reductions – to shift away from carbon intensive production. There are positive signs that the change may be already underway. A number of projects have been announced across different sectors to test the technical and commercial viability of low-carbon solutions.

In 2019, industry was responsible for approximately 40% of global emissions, including energy and process-related emissions. Steel, cement, and chemicals remain the top emitting industrial sectors. In 2019, 8% of global emissions came from steel production, 8% from cement and 3% from the chemical production. There are a number of technical and economic reasons why it is difficult to drive radical change in these parts of the economy. For example, the ‘lumpy’ investment cycles and long-lifetimes of the assets that are typically used at industrial facilities means that switching to low-carbon solutions requires advance planning and reduces the windows of opportunities when it is possible to make the investment. Additionally, the production processes in these industries are often highly integrated e.g. with output from one process



used to feed another process, and interlinked with the local infrastructure, such as grids and ports. As a result, transitioning to low-carbon technologies could often imply a major redesign of industrial facilities.

Direct emissions from the industrial sectors include emissions from direct fuel consumption and emissions generated during the production process. Industrial heat emissions can be reduced through a combination of electrification, hydrogen and carbon capture and storage, depending on the heat grades required. Lower temperature processes can switch to electric heat pumps, while higher-temperature industrial heat may require a combination of solutions including hydrogen and carbon capture and storage (CCS). Energy emissions represent less than 35% in cement production but over 80% of total emissions for steel and chemical production.

Another reason why reducing emissions from hard-to-abate sectors is particularly challenging is because some of the emissions are borne from chemical reactions that are characteristic of today's production process. In cement production, for example, more

than two thirds of emissions derive from the calcination reaction which is necessary to produce the clinker. In this case, low-carbon solutions need to go beyond fuel switching and include CCS but also clinker substitution. Some degree of substitution towards more sustainable materials and increased circularity in the economy can also be expected to play a role across the three sectors.

Steel production, whose emissions are mainly energy-related emissions, is expected to increase slightly over the coming years. Radical change in steel production can be expected over the next decade to achieve decarbonisation targets, given that a large share of current steel production involves the use of high-emitting fuels such as coal and coke. Low-carbon steel can be produced via electric arc furnaces (EAF) powered by renewable electricity in combination with the use of direct reduced iron (DRI) fuelled by low-carbon hydrogen. Both EAF and DRI technologies are market-ready; however, the use of hydrogen in DRI and the combination and optimisation of the two together is what will be required to achieve full decarbonisation. Hydrogen use – as a replacement of natural gas in the DRI process – is looking

promising. A number of pilot projects are currently testing the viability of this technology, including HYBRIT and H2 Green Steel in Sweden and the H-DRI-Project in Germany. Preliminary AFRY analysis indicates that the green hydrogen DRI route can be expected to play a major role in decarbonisation of the steel sector. This means that renewable electricity costs will be a key determinant of future steel prices.

There will not be a one-size-fits-all solution to industrial decarbonisation, but different industries, clusters and locations will require different technologies and infrastructure. Given the nature and scale of the challenge, heavy-industry emitters need to start planning now for a net-zero transformation. This means integrating net-zero into business strategy and planning activities to enable companies to make strategic choices including technology pilots, partnerships, and investment options. A first step in this direction could be development of a range of decarbonisation scenarios which reflect the uncertainty around the future energy, technology, and policy environment designed to evaluate different combinations of solutions along the path to net-zero.

There will not be a one-size fits all solution to industrial decarbonisation, but different industries, clusters and locations will require different technologies and infrastructure.



AFRY  
AF PÖYRY

# Be brave.

We at AFRY Management Consulting are committed to accelerating change towards a sustainable world in the interest of future generations. We are passionate about transforming industries and creating value for clients and society.

We strongly believe that change happens when exceptional people with brave ideas come together.

AFRY Management Consulting works globally to address challenges and opportunities in the energy, bioindustry, infrastructure, industrial and future mobility sectors through:

- strategic advice
- forward looking market analysis
- operational and digital transformation
- M&A and transaction services

With over 500 consultants in 17 offices on 3 continents, supported by 16,000 experts at AFRY in design, engineering and digitalisation, we are driven by the idea of helping our clients find solutions to business critical questions.

We don't care about making history.  
We care about making future.



For more information visit the AFRY Management Consulting web page and get in touch if you are interested in making future together with us.



# Future investment

Green Finance consists of all forms of capital invested in projects or companies that support or provide sustainable development projects and initiatives. The criteria at the basis of the evolution of Green Finance are driven by important milestones set during the last decade, such as:

- the **Non-Financial Reporting Directive (2014)**, introducing **Environmental, Social and Governance (ESG) metrics for disclosing non-financial information**,
- the **“Sustainable Development Goals” (SDGs)**, as part of the **United Nation’s 2030 Agenda for Sustainable Development**,
- the **EU Taxonomy Regulation (2020)**, introducing specific criteria to define business activities as “sustainable”,
- the **Sustainable Finance Disclosure Regulation (2021)**, introducing mandatory ESG disclosures for financial market participants,

which represent disruptive regulatory changes for investors and companies in relationships with stakeholders.

Despite expectations to see sustainability overshadowed by the financial crisis triggered by the

pandemic, Covid-19 has pushed companies and institutions to strengthen their commitment to promote a more sustainable recovery. Similarly, it has made investors systematically consider the ESG implications of their investment decisions, given the direct correlation of high ESG ratings with the financial performance of their portfolios.

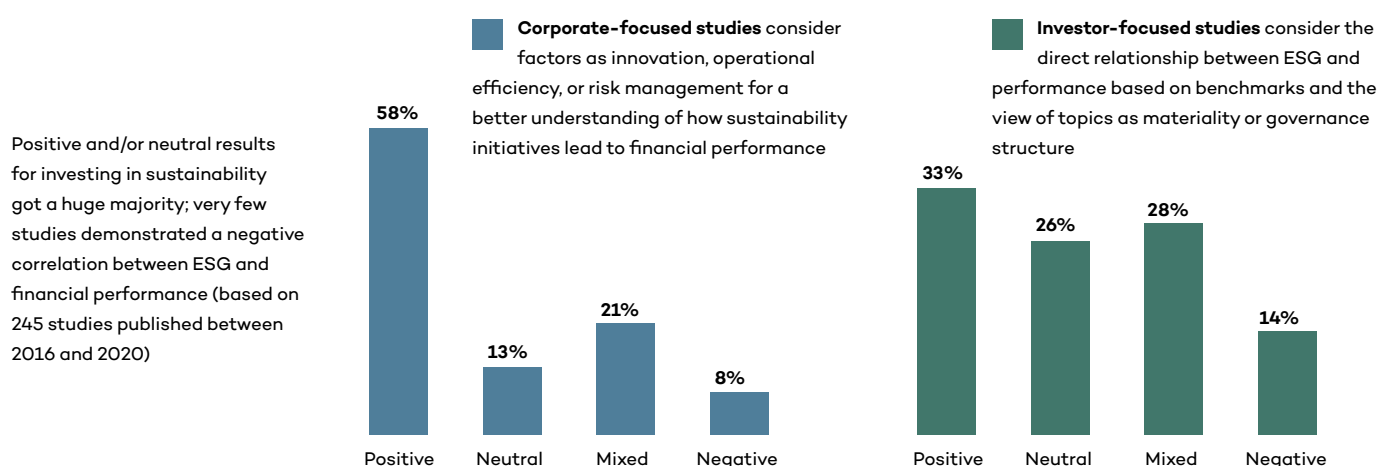
Companies with a structured ESG-based risk-management approach are in fact considered to be less risky by the market, owing to the lower probability of incurring compliance or reputational losses. In this context, the interest of investors, historically focused mainly on environmental issues, has been growing on other “S” and “G” topics, due to the strict relationship between the structured ESG commitment and the financial performance of companies.

Several studies show that businesses characterised by higher ESG ratings obtain higher differential returns. The market particularly rewards companies that pursue good practices, especially in all the three fields of environment, social and governance rather than in just one of them. The best strategic portfolio-investment schemes are

those that combine ESG ratings with a fundamental analysis of the KPIs, in particular the Price/Earnings Per Share ratio, further demonstrating the advantages obtainable in asset allocation from an integrated approach. An in-depth analysis on the determinants of performance for stocks industrial index reveals that companies with high ESG ratings have been more efficient both in increasing turnover volumes and in improving the operating margin and the dividend yield.

Several studies and reports demonstrate the already close relationship between ESG commitment and financial returns:

- **Reports on the results of a study compiled by the NYU Stern Center for Sustainable Business and the Rockefeller Asset Management: After analysing the correlation between ESG and financial performance in more than 245 research papers from 2016 to 2020, a positive relationship was found in the majority of the studies.**
- **Considering the Banor SIM study of Stoxx® Europe 600 index on the period 2012-2018, the study shows that the enterprises with higher ESG ratings obtain higher returns.**





Green finance, through ESG driven choices, represents therefore a high-potential market, channelling investments into the transition to a sustainable, resource-efficient and fair economy. In 2020, in the EU, sustainable investment funds had a turnover of € 223 billion, almost double in relation to the previous year. Issuance of green debt instruments continued to grow in the first half of 2021, with volumes more than doubling to over € 200 billion compared to H1 2020, which represents a record for any half-year period since market inception in 2007. This is an obligation which, at the end of a certain period of time, results in a return on investments having a green effect (energy efficiency, eco-friendly construction, new models of management, treatment and disposal of waste) with the related interests.

As confirmed by ISPI (Italian Institute for International Political Studies), the total issuance of green bonds in 2021 was worth more than

€ 300 billion and could reach the threshold of € 1 billion within two years. More generally, ESG financial instruments, which also include green bonds, are now worth ten times as much and in the third quarter of 2021 they almost reached US\$ 4 trillion.

In order to deepen the discussion about the mission of companies to deliver both ESG purpose and business profit, several books and reports are available – one of them is surely Alex Edman's recent book "Grow the pie" ([www.growthepie.net](http://www.growthepie.net)), about the increasing societal urge to match investors' and stakeholders' interests.

#### **Act now**

Companies today are focused on challenges with a strong environmental connotation, but in order to face them it is necessary to adopt a wider sustainability structured approach. This is necessary in order to avoid that the effects of these challenges lead to social and governance implications

of equal importance (workers' health and safety, social conditions, corruption risks, etc), involving "collateral" costs and worse financial KPIs. In this context:

- **investors need to verify how their portfolio companies are performing in terms of ESG ratings and scorings;**
- **companies need to increase their commitment on all the sustainability topics, by fixing quantitative ESG targets (including the setting of MbOs not limited to the financial KPIs);**
- **financial institutions require evidences for ESG commitment, allowing a decrease in cost of capital for companies with higher ESG scores.**

Integrating sustainability into the corporate strategy means evaluating such risks in advance and acting on the creation of company value.



# A round in the US

Six years after the Paris Agreement was signed, the energy transition is materialising. Although fossil fuels continue to dominate the global generation mix, renewables are growing at a faster pace than previously seen. What about the USA?



In the United States, the development of solar energy last year for the first time outpaced onshore wind to become the leading renewable technology. Energy storage and offshore wind development are gaining momentum, diversifying the supply mix. Renewable and energy transition-focused fundraising dramatically increased, both in the number and sizes of funds – a trend expected to continue.

The European Union has launched initiatives to thwart climate change, such as the 'Fit for 55' package, aimed at reducing GHG emissions by 55% by 2030, compared to 1990 levels. So how does the US' energy transition plan compare?

## US State of Affairs

The US Government is committed to achieving net-zero by 2050. Last year, the Biden Administration targeted a 50-52% reduction from 2005 levels in economy-wide net GHG pollution by 2030.

The US energy transition has reached a tipping point. Last year, Congress passed the Infrastructure Investment and Jobs Act ("Infrastructure Bill"), a bipartisan infrastructure package providing \$1.2 trillion in funding to help modernise traditional, physical infrastructure. The Bill provides allocations for renewable energy, transmission infrastructure, resiliency projects, grants for charging and fuelling infrastructure,

and appropriations for R&D in clean energy and carbon capture technologies. Considerable emphasis exists on bolstering the reliability and security of the US power grid.

The landmark Build Back Better Act ("BBB Bill") proposed by the Biden Administration would have provided an additional \$1.75 trillion in funding over a 10-year period for social infrastructures, and substantial provisions for investment in clean energy and climate programmes. However, the BBB Bill failed to pass the Senate and is effectively dead at this time. Despite this, the US transition is progressing swiftly, especially in the power sector supported by stakeholders.

Electric utilities are leading the decarbonisation of the power sector through investments in traditional (onshore wind and solar) and emerging clean energy technologies, such as energy storage, EV infrastructure, hydrogen, and grid reliability/modernisation projects. Many of these technologies are expected to attract investments beyond 2022. To fund capital-intensive decarbonisation initiatives, regulated utilities are finding unconventional ways to raise capital, including the sale of minority stakes in their subsidiaries to financial investors and domestic/international utilities.

Oil and gas companies have started to outline initiatives to support the energy transition through strategic

investments across the clean energy value chain. Notable examples include Shell, BP, Total, Repsol, Equinor, and Orsted. These entities are leveraging their offshore drilling experience to become leaders in offshore wind development in the US. Shell is building a 250MW cogeneration plant designed with an energy-efficient gas cracker using a hydrogen fuel source, supplying electricity to local homes. Its renewable natural gas portfolio continues to grow, launching a biomethane facility in Oregon in 2021 and planning additional facilities in Idaho and Kansas. Total is planning to expand the footprint of its clean energy and low carbon operations by launching the Cameron LNG project in Louisiana, securing an offshore wind lease area in the New York Bight, and investing in innovative cleantech companies, e.g. Stem.

There is a “push and pull” effect accelerating the energy transition, driving unprecedented amounts of capital into low carbon investments in the energy sector – a trend expected to continue in coming years. Regulatory, social, and investor pressures are pushing towards renewable and clean energy technologies. Renewable Portfolio Standards, regulations increasing renewable electricity generation, have been adopted by 29 US states, which leads to greater competition and efficiency, ensuring renewable energy is delivered at the lowest possible cost. The Biden Administration’s Clean Energy for America Act aims to extend tax credit availability, enabling companies to innovate with confidence. Environmental grassroots movements and evolving consumer preferences have forced the hand of regulatory bodies and corporations. Investor pressure could lead to a further increase in clean technology adoption. Larry Fink, CEO of BlackRock, stated in his annual letter to CEOs that those not planning for a carbon-free future risk being left behind. Fink branded “the next 1,000 unicorns” as sustainable innovators helping to decarbonise society and sees a “tectonic shift” with sustainable investments already reaching US\$ 4 trillion. With extreme weather conditions increasing in frequency over 2021, ESG issues have grown in importance amongst investors with investments in the field now accounting for 10% of worldwide fund assets. Institutional investors are viewing assets through an ESG lens and pushing companies to embrace ESG values. Pull factors are largely economic ones that include declining capital costs, improved performance driven by technological innovation, and the evolution of renewable generation sources.

### **Sustainable Development Goals (SDGs)**

The energy transition directly links to the United Nations’ SDG of ensuring worldwide access to affordable, reliable, and sustainable energy. Increasing renewable energy sources connected to the grid requires lowering renewable costs, and the Department of Energy plans to invest in clean energy R&D, supply chains of critical materials, and tax cuts for new and retooled factories for advanced energy manufacturing. In the transportation sector, there will be investments in initiatives enabling a target of 50% zero-emission sales by 2030. Indirect linkages to other

SDGs exist, such as good health and well-being, decent work and economic growth, and climate action. Achieving decarbonisation can mitigate the impacts of climate change, improving air quality in cities and communities, ultimately enhancing health and well-being.

Equally important as well-developed plans are effective indicators that measure and track progress towards achieving the SDGs. Access to clean energy can be quantified through the number of users benefitting from improved energy access, and the level of improvement in affordability, reliability, and quality. Renewable energy progress can be tracked by observing the share of renewables in total energy consumption. Computation of this data will require the full energy balance to be available and decisions regarding assumptions for electricity and heat.

### **Risks and challenges**

The energy transition is a long game that requires a unified front consisting of all stakeholders – governments, corporations, investors, and the public. Otherwise, adherence to the SDGs and fulfillment of net-zero targets will become harder to achieve. It is critical that policies and regulations reflect consistency with regard to advancing the net-zero agenda irrespective of which party is in power. An incoming administration reversing previously enacted net-zero related policies risks detracting from achieving decarbonisation goals.

There is a risk of potential job losses in the fossil-fuel production; therefore, impacted communities must be supported through job placements and retraining in renewable and clean energy fields.

Maintaining reliability with intermittent resources supplying power to the grid will be challenging and requires more investments in networks and flexible resources. Demand-side, distributed, and storage resources are examples of potential solutions that ensure the electrical grid is sufficiently flexible and diverse all the time.

It is imperative that retail electricity costs faced by end-use customers remain affordable and provide the necessary access to participate in the economic benefits of the clean energy transition. Otherwise, there is a risk of losing this segment’s cooperation.

Achieving an inclusive and just energy transition will require affordable and reliable access to clean energy paired with widespread reductions in GHG emissions across all sectors. The transition presents a combination of positive financial, environmental, and societal opportunities that should be shared by all, which means we have a collective responsibility to ensure no one is left behind – people and businesses. We need to act now and take brave steps to create a sustainable future that will benefit many generations to come.

Are we ready for the challenge?





# Stored in water

The world's hunger for energy grows year after year. Renewable energy is only one part of a sustainable solution which poses a major challenge, especially for utilities. Another part of the solution is energy storage that keeps energy in reserve for the times when it is needed. With its technical expertise in the field of hydro power, AFRY supports a start-up whose bold concept promises a sustainable balance for the energy system of the future.

At first glance, mining and renewable energies have little to do with each other. However, with the energy transition increasing in speed and steadily rising retail prices for electricity, the cards are being reshuffled and an old idea is gaining new momentum: converting abandoned mines into hydropower plants. The Swedish start-up Mine Storage wants to deal a new deck and is applying for EU funding to implement the first project worldwide - with know-how support from AFRY.

## First of its kind

"We specifically support Mine Storage with our technical expertise in pump power regarding the EU-application", says Patrik Björkholm, Section Manager Automation & Hydro Power Engineering at AFRY. The international consortium consisting of mining companies Boliden and Lovisagruvan, energy company Mälarenergi, hydropower equipment manufacturer Voith Hydro and AFRY, was granted funding to finalise the blueprint for what could be the world's first underground

mine storage facility in the historical mining area of Bergslagen in Sweden.

## What is it all about?

Pumped storage power plants in general store energy by pumping water with surplus electricity to higher altitudes and produce electricity when they let it come back down, when the energy is needed. However, natural landscapes often have to make way for the huge reservoirs. So why not outsource the power plants to old mines? As simple and revolutionary as the idea is, in the past it was not implemented under the given conditions for various reasons, including economic considerations. Today, circumstances have changed and the old idea of installing pumped-storage plants in abandoned mines is gaining momentum again.

"It is great fun for us at AFRY to be able to contribute to a pioneering technology that is in line with our vision, to work with sustainable solutions for future generations", says Patrik Björkholm.

Under the direction of Mine Storage, the consortium will join forces to compile a complete blueprint for setting up the storage facility in Bergslagen, including all the steps in the process from initial landowner and authority approval, to a grid-connected energy storage and supply facility. The work is conducted within the Strategic Innovation Program for Swedish Mining Innovation, a collaboration between Sweden's Innovation Agency, Formas and Sweden's Energy Agency.

AFRY's commitment to accelerating the energy transition is shown in the Clean Energy initiative. AFRY has supported the transition to low carbon, clean energy power sources, and energy efficiency since the early 1990s. In addition, we have been at the forefront of technical innovations in hydropower for many years.

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# Making Future

