# The Green Bond

## Your insight into sustainable finance

22 March 2023

# In this issue

## The Water Issue

# Letter to the reader

## Stormy ocean

Dear Reader,

A few weeks ago, this letter would have been much easier to write – the times were straight forward, and, despite geopolitical uncertainty, we knew that the core focus was on moving towards more resource efficient, governed supply chains and low carbon society. Then this letter would address the topic of moving from CO2 financial management to water financial management.

However, the current financial turmoil and the potential (and likely) impact on leverage and risk willingness, need to be brought into the equation. Two weeks ago, I would have argued that the ongoing UN conference would not only be the "Paris agreement" on water – but would kick start a process on how the World would embrace water concerns like we have embrace CO2 concerns – and how we would do this much faster and much more aggressively.

I still believe that this will be the "Paris" moment for water, but the muscle and momentum of the financial sector is not what it was in 2015 (and forward). Hence, we simply need to re-create comfort and trust before the mobilization and expansion will bite – which might require some time. Saying that, it is without doubt, that water will be one of our biggest concerns moving forward – and that this will trigger significant investments across the World. We are talking about both water quality and water quantity, as well as how we organize ourselves to address these challenges.

In most of the World, the water infrastructure is 50 to 100 years old, inefficient, and not designed to serve the urbanization we have witnessed over the last many decades, hence redesign and upgrades are required. Additionally, we are seeing physical changes to our water infrastructure (flooding, droughts, change in rain-patterns etc) which will challenge us and lead to either water infrastructure investments or migrations.

It is our expectation that these challenges will result in changing legislation to ensure better water management from the corporate sector, increased water taxes to pay for the needed investments and subsidies/grants to mitigate migration and improve living quality. So, in other words, a minefield of risk and opportunities.

For these reasons, we have dedicated today's edition of The Green Bond to water. You will have a number of contributions, written by key players to highlight their perspectives, and we will make sure to follow up on this in future editions of the report.

Enjoy your reading!

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# Transition update

## The end of the beginning

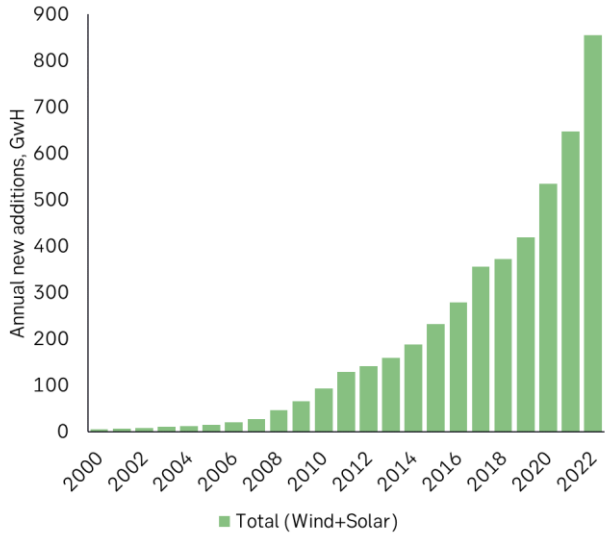
The annual increase in capacity is now larger than the trend growth in total energy consumption, which means we are now close to a peak in $CO_2$ emissions. This is only the end of the beginning, and decades of hard work still lie ahead. However, it means we can turn the focus to the next challenge. Successful transition means all parts of the supply chain for both energy producers and users must move in lockstep, and this will require policy support and plenty of capital beyond renewable energy.

### The end of the beginning: peak $CO_2$ emissions

The surge in renewable energy investment over the past few years has now taken us to what could be called the end of the beginning in the clean energy transition: the peak in $CO_2$ emissions.

This is not the beginning of the end: it will take at least three decades to complete the transition to a zero-emission economy. However, it is a major breakthrough, and it means we still have a realistic chance of getting there by 2050.

**Figure 1 Annual change in installed capacity**




Source: BNEF

The rising trend in renewable energy investment has been gaining momentum as successive energy crisis rolled through first China (at the end of 2021) and then Europe during 2022.

However, it is only now that the resulting exponential increase in the supply of renewable energy supply is clear (Figure 1). While it is still early days, we are already starting to see some very encouraging developments on the back of this increase in investment, most notably a slower increase in $CO_2$ emissions. Global emissions did increase by around 1% in 2022, but this was less than feared after the lockdown effect of the preceding years.

A recent analysis from the IEA [1]decomposed last year's emission increase relative to the historical trend into actual increases and avoided increases that can be attributed to changes in the energy mix as well as cyclical changes in economic activity. The main takeaway is that the increase in emissions could have been 2-3 times larger without offsetting increases in the supply of zero-emission energy (and an industrial slowdown).

This means that we have reached the end of the beginning for the clean energy transition: the point where the annual increase in the zero-emission energy supply outpaces the increase in total energy consumption and total $CO_2$ emissions start falling (Figure 2).

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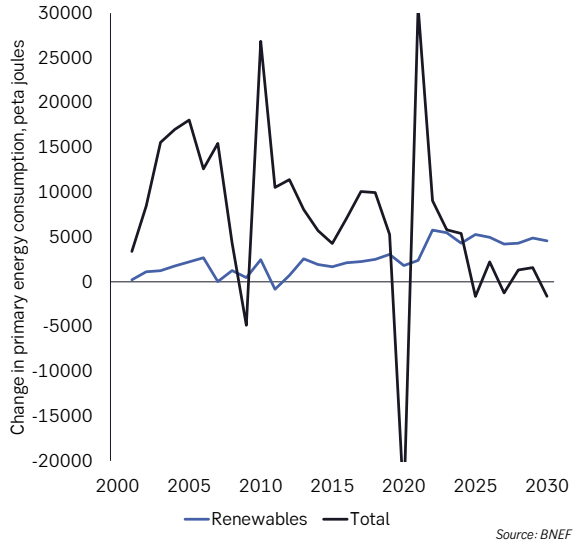
[1] CO2 Emissions in 2022 – Analysis - IEA

**Figure 2 Change in primary energy consumption, by fuel**



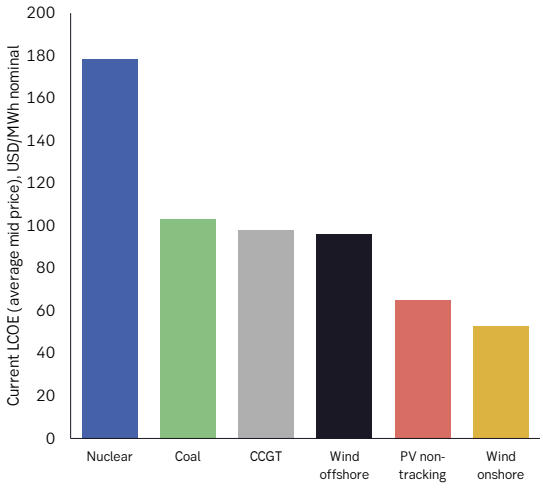

Source: BNEF

This is not the beginning of the end for the transition or in any way cause for complacency, though. The dangers are abundantly clear in the new IPCC synthesis report[2]. The authors warn that *human-caused climate change is already affecting many weather and climate extremes in every region across the globe. This has led to widespread adverse impacts and related losses and damages to nature and people*. However, there is also a more hopeful tone from the IPCC authors, who note that *feasible, effective, and low-cost options for mitigation and adaptation are already available*.

## Renewable energy has passed tipping point

The main reason why we see a sustained surge in renewable energy investment is technological superiority combined with political action.

**Figure 3 LCOE**



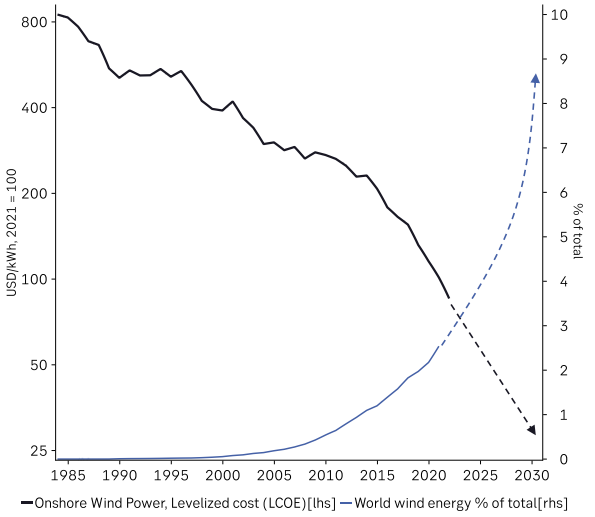

Source: BNEF

After over 30 years of development, renewable energy is now cheaper than all other energy sources on a 'cradle-to-grave' basis, Figure 3.

More importantly, the collapse in prices we have seen over the past decades has the learning curve hallmark of a true technology revolution.

The more capacity we install, the lower the price of the renewable energy that is produced, like what happened for microprocessors, steamships, automobiles, and other technological revolutions in the past. On top of this, there has been a huge change in the political priority given to clean energy investments after the energy shocks of the early 2020s, suggesting this will now proceed faster than those historical transitions.

**Figure 4 Positive feedback loop for renewable energy**




Source: BNEF, Macrobond

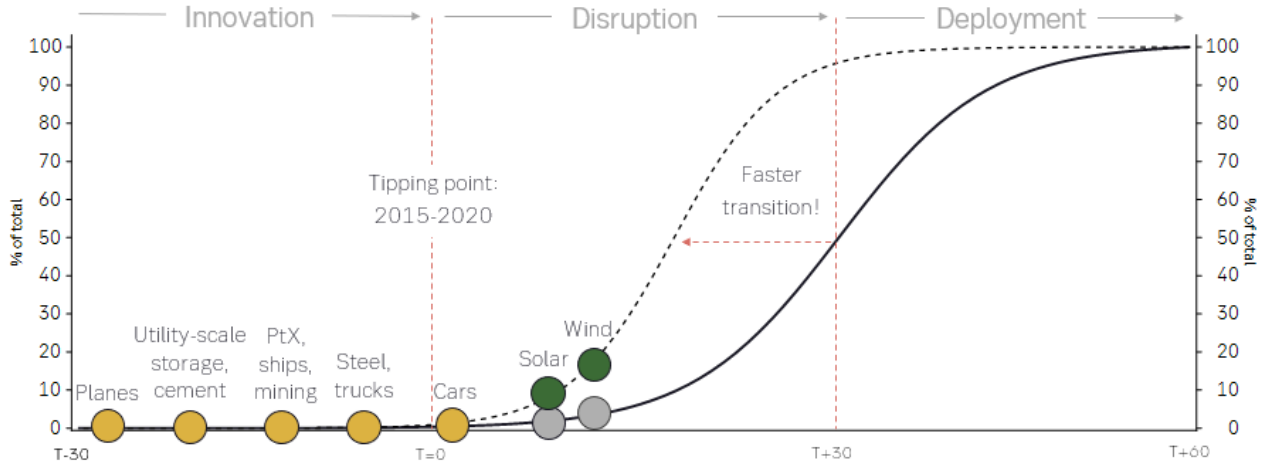
While this is a key step on the road to decarbonization, it also forces us to focus on a range of new challenges related to the complexity of a system-wide technology diffusion of something as integral to all economic activity as the energy infrastructure. The key issue is that successful transition will require all parts of the system to move in lockstep, both on the supply and demand side.

## How about the rest of the supply chain?

This development is in line with the diffusion of disruptive new 'General Purpose Technologies'. Over the past 250 years, all new technologies have spent around 30 years in incubation before they became useful, then 30 years in disruption as scale effects kick in and prices decline and finally, once 50% diffusion is reached, 30 years of more stable deployment of a now mature technology.

[2] AR6 Synthesis Report: Climate Change 2023 — IPCC

**Figure 5 Fast transition challenges**




Source: SEB

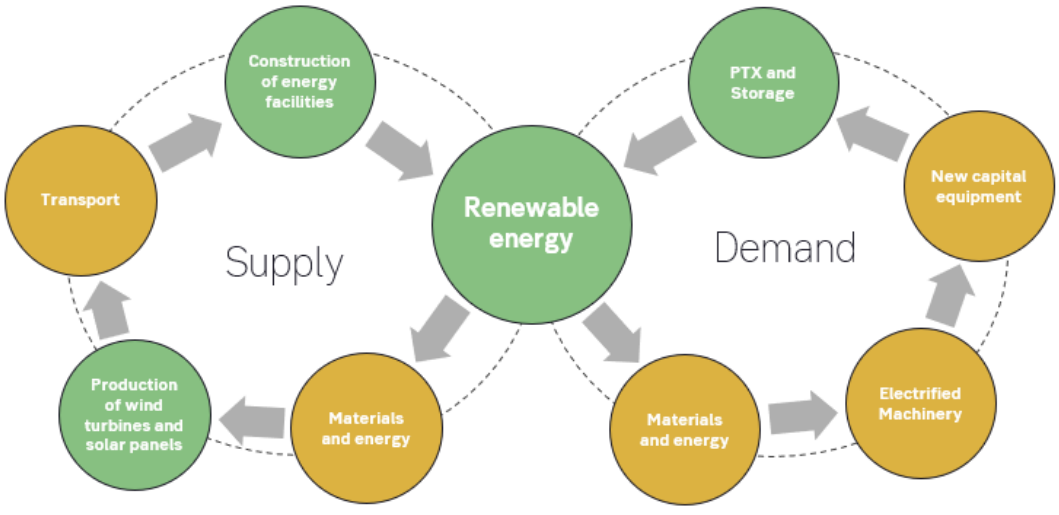
Renewables are well past the tipping point and now experiencing exponential growth, following a pattern like earlier technology cycles, even if it is now happening at a faster pace than seen before. However, most of the complementary technologies that will allow energy users to switch to clean electricity as the main energy input are still in the incubation phase where they require subsidies, and where the final version of the new technology which will be deployed remains highly uncertain (Figure 5).

However, an accelerated transition will require that all parts of the value chain move together. The demand for clean electricity must increase at the same pace as the supply, for instance – there is no point building wind farms if the electricity can't be sold. But this also holds for each part of the supply chain for both supply and demand. If you run out of commodities, you can't build any windfarms, for instance, and without bunker facilities for clean fuels, zero-emission ships will not sail.

The problem right now is thus that a) most of the complementary technologies are so far behind primary energy production on the technology s-curve that they still require subsidies to be deployed, and they are crucial for the success of the renewable energy capex boom and b) there has been too little focus, over the past decades, on the need to expand the supply of materials, machinery and other physical inputs in the less obviously green parts of the supply chains for both energy producers and users.

Solving this problem will require sustained policy support for the development and deployment of clean energy technologies that are not yet profitable on a market basis (storage, power-to-x, fuel cells, new engine types), policies to increase the supply of key inputs (from essential materials to computer chips) and some kind of vertical integration across supply chains to ensure that supply and demand evolve at the same pace (like VW investing in mines or SSAB teaming up with Vattenfall and LKAB).

**Figure 6 Transition requires whole supply chains to move in lockstep**




Source: SEB

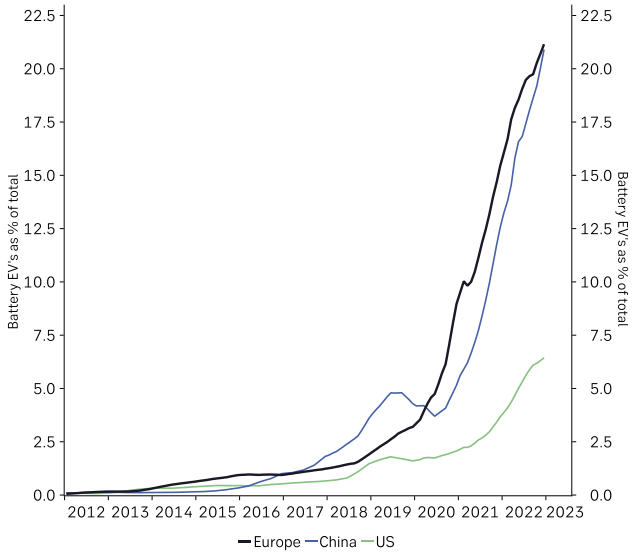
## Investment in electrification takes off as well

The second wave of investment in an accelerated transition must come from energy users in hard-to-abate sectors where production models currently require fossil energy.

The only energy-using sector that currently has a 'fully developed' zero emission technology is the automotive sector, where battery EVs arguably now have superior performance to fossil-powered vehicles at the same price without any subsidies. Again, this follows an incubation phase of more than 30 years following the start of the modern EV age in the mid-1980s with early prototypes that were totally uncompetitive. In the late 1990s, the dual-fuel Toyota Prius took electric propulsion into the mainstream, around 2010 the first pure battery EVs emerged with competitive performance if not price and over the past few years, lower prices have ended the discussion – most recently with Tesla cutting prices aggressively on its most successful models.

This is clearly reflected in the diffusion of EVs. Their share of total vehicle sales has been growing explosively in both Europe and China and now exceeds 20% in both regions (Figure 7). At the same time, the much more limited deployment in the US highlights some of the obstacles that EVs still face that ultimately could lead to other technologies taking over.

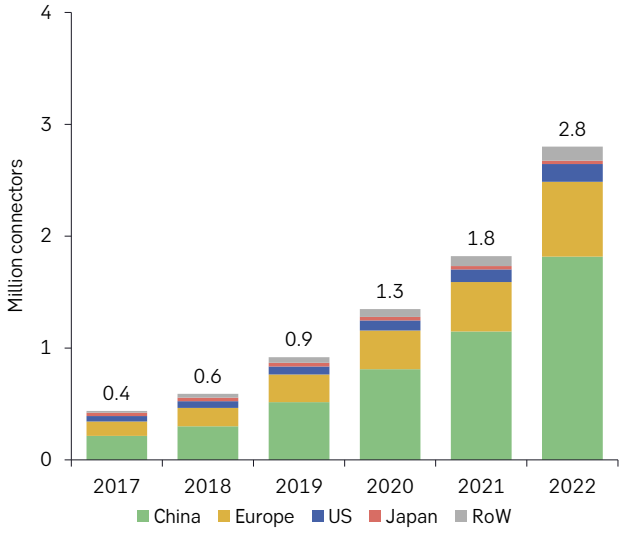
**Figure 7 Battery EVs**




Source: BNEF

The most pressing concern for EVs broadly speaking is their weight and resource intensity. Due to the characteristics of the best batteries currently available, it is very difficult to reach sufficient range in a small EV, and most successful versions weigh in at more than 2000 kilogram. The batteries are not only large and heavy, but also require inputs of scarce commodities where it is difficult to increase supply in the near term. This makes EV emissions look a lot worse in a Scope 3 than a scope 1 analysis and it could also ultimately increase the cost of EVs if resources become more expensive to source. Better batteries are key to avoid a challenge from hydrogen fuel cell vehicles that also have good performance but need cheaper green hydrogen.

**Figure 8 Cumulative global public connectors installed**




Source: BNEF

However, other parts of the supply chain may also slow the transition to EVs. The most notable problem is the lack of charging units, without which even the best EVs cannot drive. Scaling charger networks is difficult because it requires capital, standardized technology, and access to more powerful grids, because the existing network was not geared for this kind of volume.

Grids in turn are also both capital- and resource-intensive, and they are typically not funded by the same entities that set up the charging networks. All of this is cheaper and easier in more densely populated areas, and like with the EVs themselves, China and Europe are way ahead in this area, while the lack of access to chargers most likely is a key explanation for the lack of EV take-up in the US, where commuting distances e.g. tend to be longer.

## Europe, US play policy catch up with China

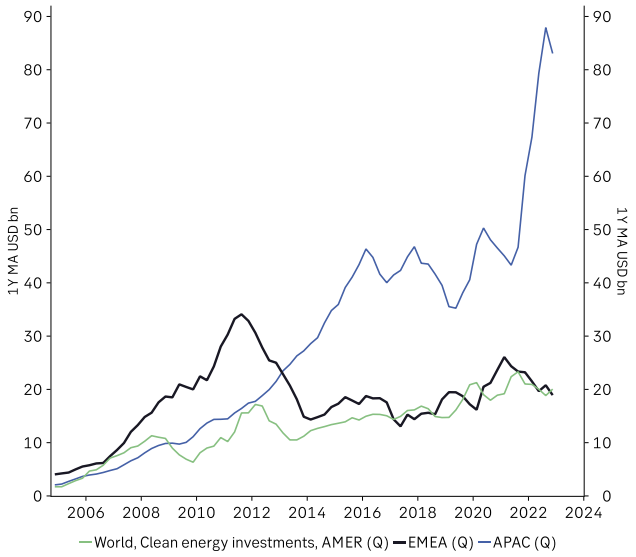
During the early years of the transition, policymakers mainly saw high emissions as an economic 'externality' which could be addressed by adjusting prices. According to this line of thought, the cost of fossil fuels was too low to reflect their true cost for society, and if you just made it more expensive then the market would fix the rest.

This is in theory correct, but it would require spending a lot of time which is a luxury we do not have right now. Boosting the supply of renewable energy and driving the price lower with government support was the next step, but this is now

running into the coordination problems described above. If successful use of clean electricity requires transforming whole supply chains at the same pace and some parts are not ready for that, then a much more comprehensive industrial policy is needed to nurture the most needed technologies towards the tipping point faster.

This policy framework is currently emerging fast in the three major economic regions. China has taken a clear lead, as is evident in Figure 9, which shows China's renewable energy investment doubling in just a couple of years and with no similar movement in Europe and the US.

**Figure 9 Investment in clean energy investments**




Source: BNEF

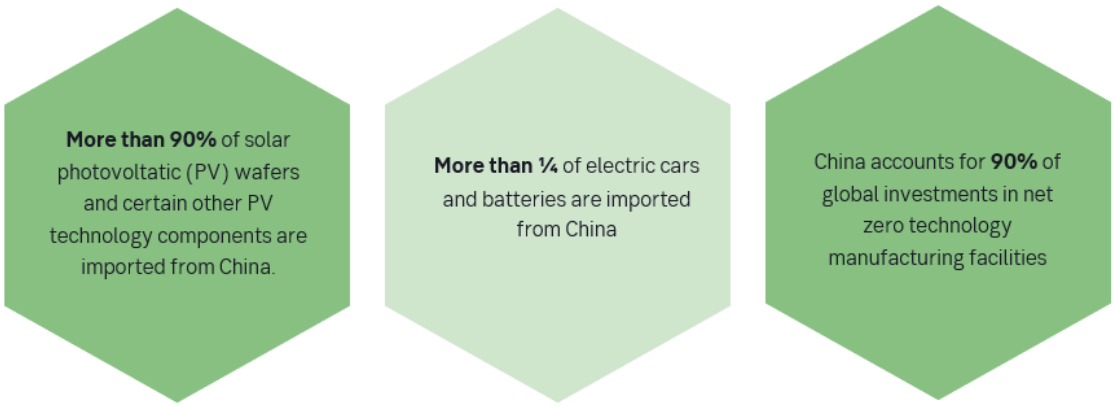
However, there are now indications of a policy revolution, breaking with decades of free-market convention, in both Europe and the US. The IRA in the US and Europe's Green Deal Industrial Plan show that this is a new global policy regime, a return to the industrial policies from before the free market revolution of the 1980s. The result is likely to be that investment takes off exponentially, not only in renewable energy but across the whole supply chain for both energy users and producers. It is also clear that the underlying driver for these changes is geopolitical competition, not concern for the future of the planet and that it involves an element of protectionism.

Figure 10 is taken from the EU's own material supporting the Net Zero Industry act – this is very much focused on the geopolitical aspects of the transition and the need to secure local supplies instead of depending on Chinese supply. And it's not just about energy itself but about the whole supply chain for renewable energy, including key components, production and manufacturing facilities and commodities.

Similar thinking is behind not just the IRA act in the US with its widespread subsidies for a broad range of complementary technologies but also the CHIPS act aiming to support the nearshoring of key production facilities. There is little doubt that the IRA forced Europe's policymakers to go down the same road to prevent an exodus of clean energy technology companies to the US. And the US appears to have looked at China and realized they were falling behind in one of the truly decisive technology fields. This is clearly and 'economic arms race' with the side effect being a cleaner energy system.

While this is very positive news for the future of the planet, there are still a couple of major obstacles to be resolved. The first if the availability of physical resources, which may be limited in the near term regardless of what policymakers do. The second is the provision of capital and incentives for companies to experiment with clean technologies before they reach the tipping point.

**Figure 10 Currently EU depends on imports for many net-zero technologies**



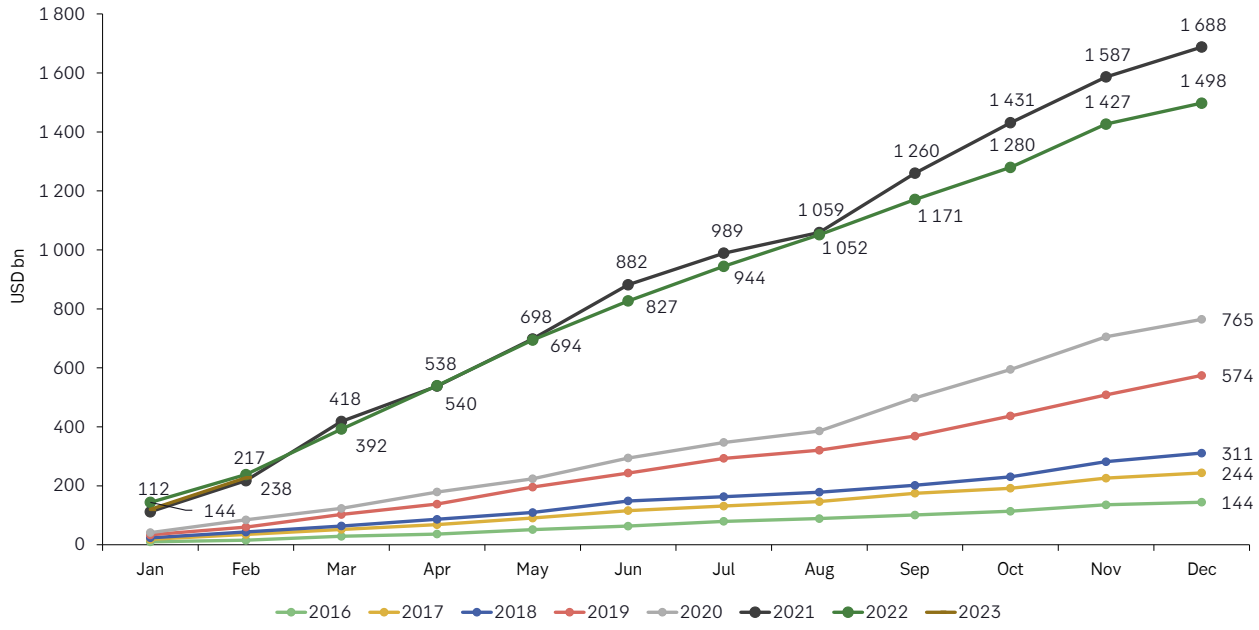

Source: Factsheet: Net Zero Industry Act (europa.eu)

# Sustainable Debt Market Update

Recovery on its way

The sustainable finance market saw the second-best start of a new year on record. A total of USD 227.3bn in new labelled bonds and loans have been transacted so far this year driven by a strong return of supranational other public institutions to the market. An accelerated transition, powered by a structural change in policies to promote other parts of the supply chains engaged in the transition, is set to be a game-changer for equity investors

**Figure 11 Cumulative sustainable debt transactions**



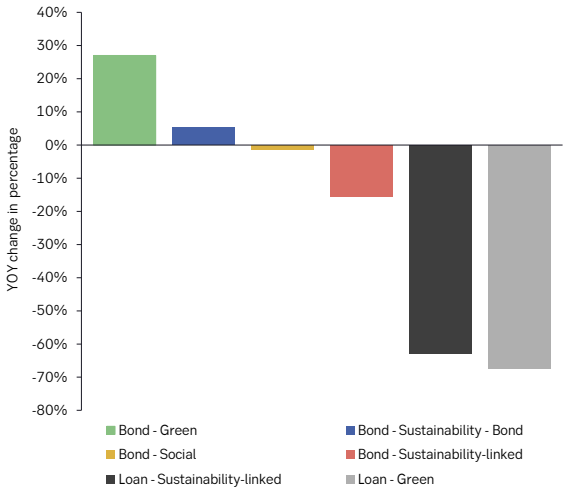

Source: Bloomberg New Energy Finance 28 February 2023

## Sustainable finance market back on track

The first two months of 2023 have seen the market for sustainable bonds and loans posting its second-best start of the year on record. With a total of USD 227.3bn in labelled debt transacted in January and February 2023 may well see the sustainable finance market return to its growth trajectory.

Looking at the product level, the first two months of the year have seen green bonds growing with 27% Y/Y and totalling USD120bn in new issuances. Sustainability bonds also grew year-over-year by 5% and reaching USD 27bn in new transactions. On the other hand, green loans and sustainability-linked loans have seen declines of 67% and 63% respectively.

**Figure 12 Y/Y change in sustainable debt market by product type, Jan-Feb**




Source: Bloomberg New Energy Finance 28 February 2023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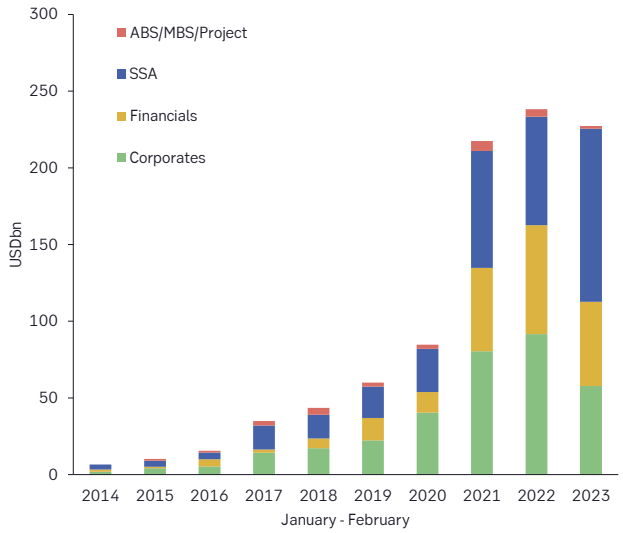
## Supranationals, governments drive comeback

The first two months of 2023 also saw a resurgence of sustainable debt from supranational institutions, sovereign and agencies (SSA). Compared to the same period last year, new sustainable bonds from SSA grew by 60% to USD 112.9bn which is already more than a quarter of what the sector issued in all of 2022. There have already been 40 deals or more than USD 1bn in ticket size in 2023. Furthermore, green bond issuances by supranational institutions and public sector entities have more than-doubled Y/Y reaching almost USD 54.8bn in new financing alone followed by sustainability-linked bonds with USD 36.8bn (+35% Y/Y) of new issuances.

**Figure 13 Sustainable debt market by sector, Jan-Feb**




Source: Bloomberg New Energy Finance 28 February 2023

## Economic losses and investments needed to reach SDG 6

Economic losses related to water insecurity include USD 260 bn per year from inadequate water supply and sanitation and USD 94 bn per year of water insecurity to existing irrigators[3]. According to a recent survey, 69% of companies stated that there is a risk of substantive impact on their business due to problems with water availability or quality[4]. Worsening water-related detrimental impacts are estimated to put more than USD 336.3bn of global business value at risk today & in the near future[5].

Looking ahead, the World Bank estimates a 40% global shortfall in water supply by 2030 if current consumption and production patterns do not change[6]. Reaching SDG 6 – Ensure availability and sustainable management of water and sanitation for all – requires 1 tn or 1.21 in global GDP according to OECD by 2030[7].

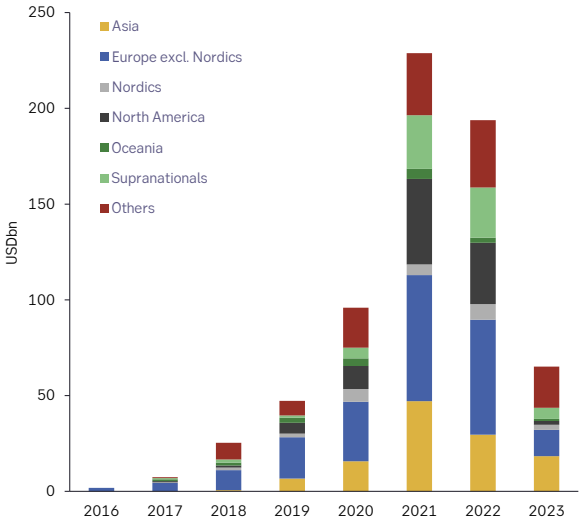
Current investments are not sufficient. Only 1.6% of institutional investments allocated to water supply and only 6% of expenditures on water and sanitation being commercial investments. The last point highlights the fact that water-related investments involve a mix of public and private benefits with limited opportunities for investors to clearly define revenues streams associated with investments. At the same time, there is a mismatch long-term fundings needs of public institutions vs. commercial investors with shorter-term horizons.

## Sustainable finance to meet SDG 6 might be rising but difficult to assess

Figure 14 shows bonds issuances that in their documentation listed SDG as one impact area. The proceeds or the underlying performance-based structure of these bonds are directed at investments or targets that issuers believe will support the implementation of SDG 6.

The data suggests that sustainable financing that is at least partly pledged to SDG 6 related actions have grown until 2021. The decline in 2022 was in line with the overall decline of the sustainable finance market last year. Compared to the general sustainable finance market, issuances linked partly to SDG 6 from Asian and supranational borrowers are overrepresented.

**Figure 14 Sustainable bonds partly targeting SDG 6 by region**

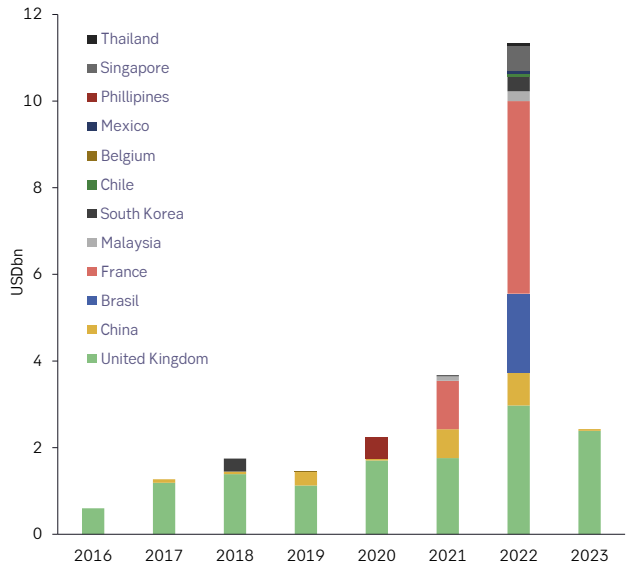



Source: Bloomberg 19 March 2023

[3] OECD 2022 Financing a Water Secure Future
[4] CDP and Planet Tracker 2022 High and Dry: How Water Issues Are Stranding Assets
[5] OECD 2022 Financing a Water Secure Future
[6] The World Bank 2026 High and Dry: Climate Change, Water, and the Economy
[7] OECD 2022 Financing a Water Secure Future

Lack of harmonized reporting standards makes it difficult to assess how much of the raised capital is going to improving access and sustainable management of water and sanitation. This makes it difficult to assess investments and performance as well as limits the knowledge of financiers and investors to make better investments in the water and sanitation space in the future.

**Figure 15: Bonds by water utilities (excl. municipalities)**




Source: Bloomberg New Energy Finance 28 February 2023

A closer look at sustainable bond issuances by water utilities shows that there had been a sudden spike in transactions last year led by five issuances of French company Suez. Historically, water utilities from the United Kingdom have accounted for most of the borrowing in this segment of the sustainable finance market. The market has also started to diversify with several Asian and Latin American water utilities starting to borrow from the internal capital market.

This data also suggests that despite the vital importance of water and sanitation for human and economic development, the opportunities for investors remain limited. The relatively small-scale and fragmented nature of water-related investments suggests high transaction costs and perceived high risks. More bankable projects with clearly defined revenue streams, viable business models and governmental buy-in may be needed to support the development of sustainable financing models.

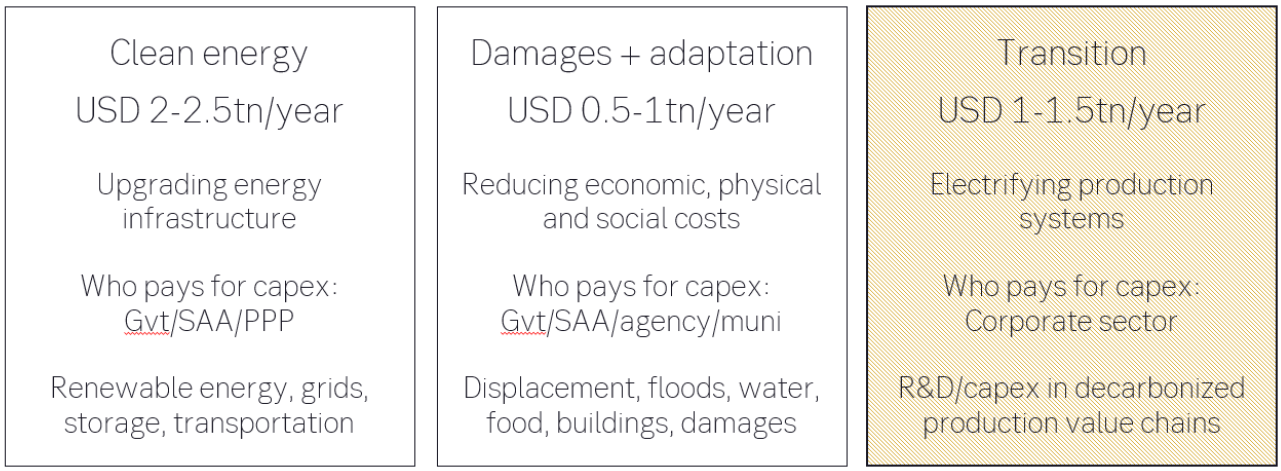
## Equities: increased competition for capital

As described in the transition update, one long-term effect of the past few years' economic upheaval is likely to be a sustained acceleration in the transition to a new energy system, including the complex business of keeping all moving parts moving at a coordinated pace. What does this mean for equity investors? And how can they make a difference if they are so inclined?

The most direct implication is that some parts of the stock market will benefit from a lasting surge in capital expenditures, accelerating volume growth for the entire value chain involved. There are essentially two big 'value chain wheels' that are turning together in this process.

The first is the investment in an increased supply of renewable energy, which is a resource-intensive process involving multiple sectors. Here governments are likely to play a key role in securing the funding either directly or through risk-sharing activities like PPAs that reduce the risk for private actors.

**Figure 16 Capital requirement for accelerated transition and climate damages**




Source: SEB

We estimate that this will require an increase in annual direct investment levels of more than USD 2 tn compared with the level in 2020.

In the middle, we have listed the estimated cost of adaptation and compensation for the uninsurable climate-related damages that now tragically appear to be inevitable. These costs are also likely to be borne by the public sector or government-sponsored entities like SSAs.

The second value chain wheel that needs to turn is the investment required for the electrification of the hard-to-abate energy-using sectors, which also is a resource-intensive process involving multiple sectors and without which the transition will ultimately fail to eliminate fossil energy consumption. Here we estimate that investment levels will have to rise by USD 1-1.5 tn compared with 2020.

The big difference, however, is that the technologies are much less developed and that the burden of raising the capital mostly will fall on the private sector, while the government involvement will work through the subsidies offered to accelerate the take-up and development of new energy technologies and to secure access to materials and other supplies.

## Where will the profits end up?

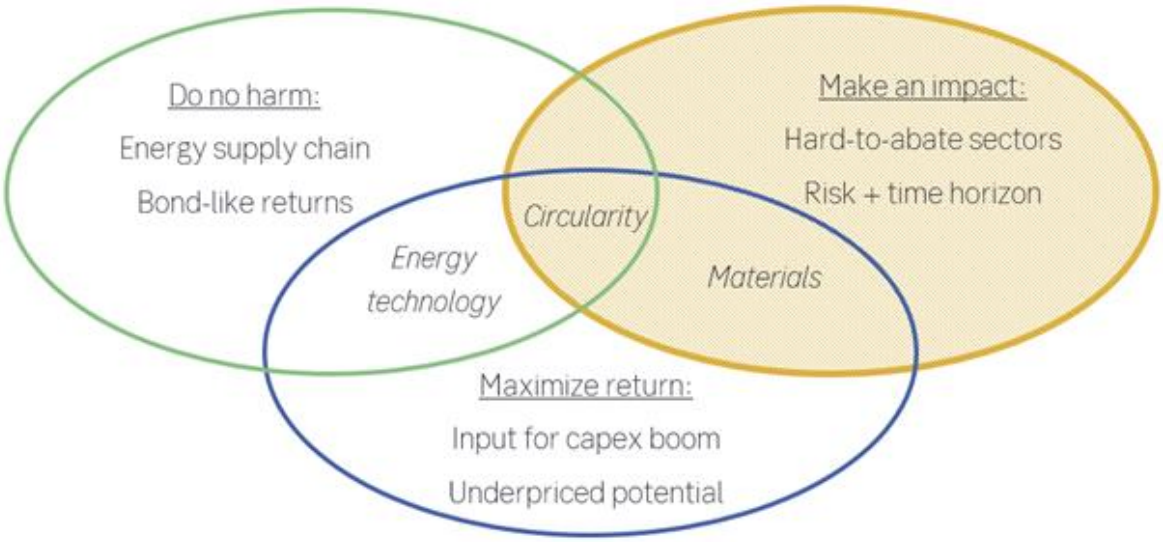
In both cases, the result is likely to be exponential volume gains over the coming 20-30 years for the entire value chain. However, the profitability will not be evenly distributed across the value chains, and in both cases, we think it will be concentrated towards the base of the supply chain. Figure 17 is a stylized illustration of the two combined investment booms.

On the left, we look at the value chain that is behind the increase in renewable energy supply. At the front end of this supply chain, there are two factors that can compress margins even if volume growth picks up. The first is that governments are reducing downside risks in this segment to provide incentives for new wind and solar projects, and this also means there will be limits on how high margins will be allowed to go; this was illustrated by the windfall taxes introduced in 2022. The second is that oil companies (at least those who want a future) have a strong incentive to recycle oil and gas profits into projects in the renewable energy segment, compressing margins for all suppliers of renewable energy.

However, if you move further up in the supply chain, similar problems are unlikely to be a major issue for the suppliers of input to the renewable energy investment. Regardless of whether the energy project has a high or low return, the suppliers of machinery, steel and other inputs will be paid, and here there is neither regulation nor new entrants with cheap capital to compress the margin. On the contrary, high margins are likely to be the market mechanism that ensures the needed increase in the supply.

The big question when assessing whether clean energy companies are likely to benefit from these trends also on the profit side is whether they have a technology 'moat' providing barriers to access for new entrants. Solar panel producers offer an example of a sector that did not.

**Figure 17 Where will transition lift equity returns?**

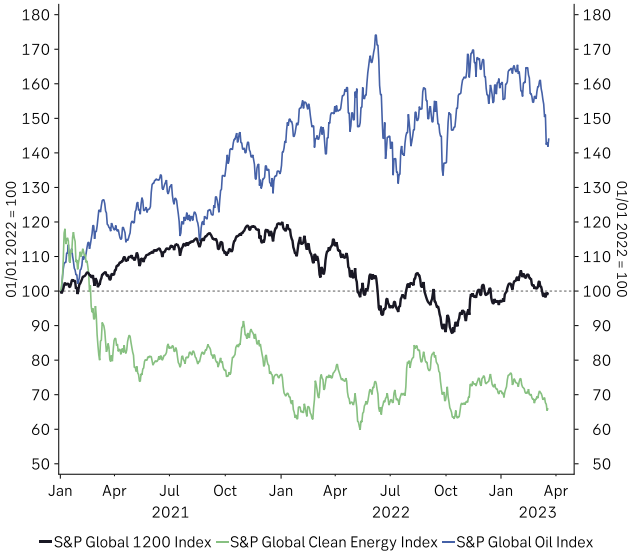



Source: SEB

If we take the S&P Global Clean Energy as a benchmark for the whole energy segment, the performance over the past few years suggest that investors are so far not convinced that this holds in general – the clean energy index has underperformed substantially since the 'ESG bubble' burst in early 2021, and until recently this was reflected in stagnant earnings expectations. More recently, however, there are signs that earnings are starting to pick up because of the increased pace of investment, so perhaps its time to take a closer look.

In our view, the real sweet spot in this supply chain that combines sustainability with high returns is found in the middle, with companies that control new energy-related technologies and benefit directly from the new industrial policy subsidies designed to accelerate the development process and secure a local presence in all major regions.

**Figure 18 Clean energy vs oil index**



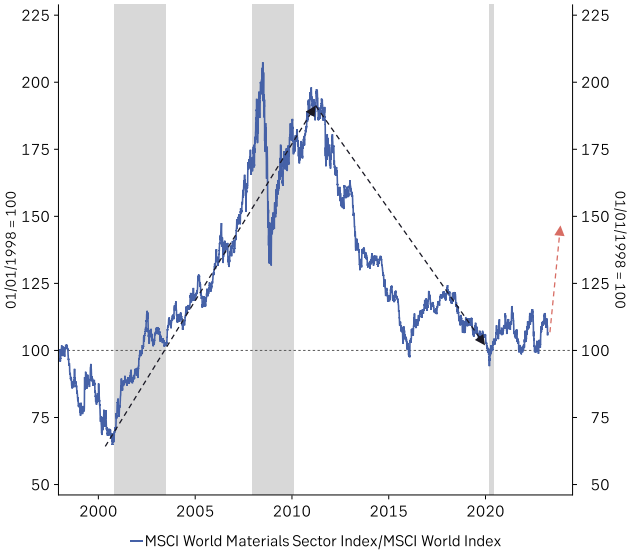

Source: Bloomberg

Moving to the right in Figure 17, the second value chain is supporting the fast electrification of hard-to-abate sectors using technologies that currently are not fully developed and where early adopters thus are unlikely to become more competitive at first. Again, we expect the case for high returns because of the faster volume gains to be weakest at the front of the supply chain, but for different reasons.

The end-users of these new untested technologies will not get direct support from governments, and they must raise capital for significant investment with a very high risk and a long time-horizon. Those who fail will not survive, because there will be no room for companies with high emissions and the elimination process will be like that of internet companies – with the successful companies gaining an unassailable lead on the cost-curve.

So, the winners in this space will be extremely successful, but the losers will go out of business, and there is no clear way to identify the two groups in advance. This suggests that aggregate risk-adjusted returns for the whole group will not be attractive. However, regardless of whether a new hydrogen vessel is profitable or not, the suppliers of the metal, engines and other machinery inside will get paid, and they are not subject to the existential transition risk.

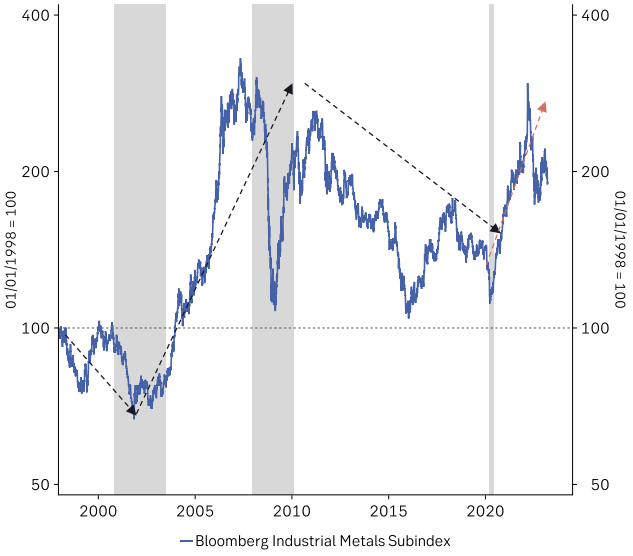
**Figure 19 Materials sector relative return**




Source: Bloomberg

Again, we think there is a sweet spot in this value chain where transition risks can be managed with less downside risks. Mining and materials is one of the sectors that will be forced to electrify the production model, but they also control the supply of crucial inputs and therefore profitability will initially be elevated for all participants.

**Figure 20 Industrial metal prices**




Source: Bloomberg

Both energy producers and users will require huge amounts of physical resources, and this marks a clear break with the trends that characterized the past decade, where the focus was on 'asset-light' companies. Even without an accelerated transition, the past decade's underinvestment would have caused supply shortages, and we are totally unprepared for the surge in demand that now looks likely. Metal prices have already broken trend, but the performance of the sector producing them remains capped.

**Sustainable investors to focus on future emissions**

If you are only looking to maximize the return of your equity portfolio without restrictions and you do not fancy yourself as a master stock-picker, the conclusion is simple: focus on the start of the supply chain and be careful closer to the end, this is likely to provide a better mix of higher volume growth and stable margins.

But what about those investors who would like to make a difference for the climate crisis with their savings? We think the analysis above is a challenge for the first iteration of sustainable equity investment strategies that focused on limiting exposure to companies with high current emissions.

First of all, if you want to make a difference, the problem is that these strategies essentially prevent the allocation of capital for investment in the sectors where the need for private capital is highest and the availability is most limited – but where you also have to navigate the risk of deploying untested technologies and identify companies that truly are on the right path from those who pay lip service or are unable to execute transition strategies successfully.

Figure 21 is a stylized attempt to illustrate the difference between the two strategies. We look at current and future emissions and identify four groups of companies.

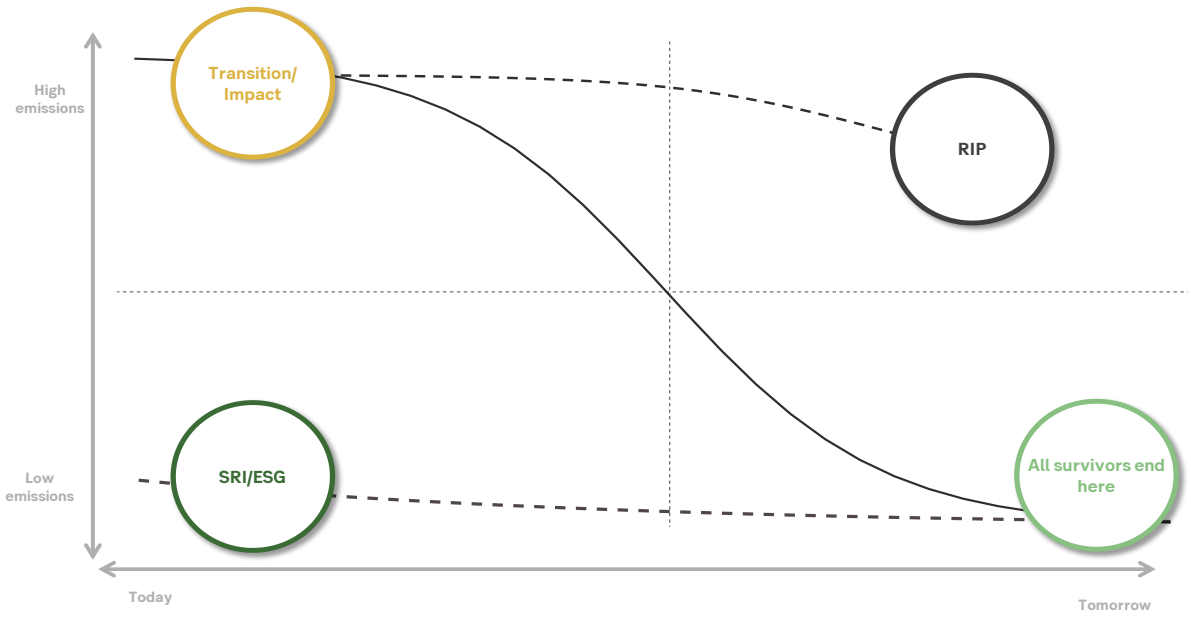
Companies that are in transition start with high emissions today in the upper left corner and will need time to change that – longer time in areas where technology is least developed today. Some companies in this group will follow the S-curve lower, eventually ending at acceptable emission levels close to zero.

The rest will unfortunately cease to exist because there will be no room for emissions, and the challenge to impact or transition investment strategies will be to identify the companies that are likely to be in the first group.

Companies that already have low emissions or are defined as 'green' (like renewable energy equipment producers) in the lower left corner are a different story. They are very likely to end up where they started when it comes to emissions, so there is limited risk of 'greenwashing'. On the other hand, it is also very difficult to claim that you make any kind of difference for the transition or the climate crisis by concentrating your portfolio in this segment, and the return is also likely to be below the market return.

At the end of the transition, the two strategies will have merged as all surviving companies will have low emissions, but in the next 10-15 years they are likely to be very different. We think this will result in a gradual shift in emphasis from the traditional ESG/SRI funds' low emission strategies towards impact/transition funds.

**Figure 21 Two main types of sustainable equity investment**




Source: SEB

# Investing in water

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## Water: the crisis you haven't heard of yet

Water may not be prominent on your investment radar yet, but it will turn up there. Like energy, water is indispensable for human life on earth. A robust and efficient water infrastructure is vital to secure society's access to safe drinking water. It also ensures economic development, prevents the spread of illnesses, protects ecosystems, and mitigates climate change – because water treatment is very energy-intensive.

You might thus expect that water would be given high priority in public spending, but in fact, we are far from being able to provide clean water and a robust infrastructure to all. 26% of the world's population lacked access to safe drinking water in 2020[8].

Even worse, the UN predicts a 40% global shortfall in water supply by 2030 if current consumption and production patterns do not change[9]. One of the reasons for the shortfall is that large amounts of water are lost due to leakages, especially in Europe and the US where water infrastructure can be as much as 150 years old.

These challenges have a large financial impact. According to a new OECD paper, water-related detrimental business impacts amounted to USD 16.7 bn in 2020. The value at risk is estimated to be more than 20 times larger[10]. To mitigate risks and achieve the goal of clean water for all by 2030, more than USD 1 tn water-related investments would be needed annually.

Governments are finally acknowledging the problem and increasing spending on water. *The US Drinking Water and Wastewater Infrastructure Act (2021)* intends to allocate USD 35 bn to improve wastewater, stormwater, drinking water and water recycling across the country. Both the *EU Green Deal* and the *US Inflation Reduction Act* include water infrastructure investments in their funding packages. The

UK Government proposed the Storm overflows discharge reduction plan (2022), requiring water companies to invest up to GBP 56 bn until 2050.

The increasing awareness of the looming crisis, together with a new wave of public infrastructure investments, is expected to trigger an increased demand for water solutions. This could be water technologies (smart meters, filters, flow management systems), infrastructure components such as pipes, valves and pumps, or infrastructure planning and construction activities.

## Construction of a water equities basket

Companies that provide water-related products and services could benefit from this trend, and so could their stock market returns, provided that the investment surge is not expected in advance. At the same time, this would offer a new way for investors to contribute to a more sustainable development. Access to clean water and sanitation is the focus of Sustainable Development Goal #6. Water will also follow climate into the EU taxonomy framework.

To capture these opportunities and to identify and understand historical return patterns, we constructed an equity basket exposed to water solutions. The goal was to identify companies with as high an exposure to water-related products and services as possible that were also considered to be sustainable investments.

[8] https://www.unwater.org/publications/summary-progress-update-2021-sdg-6-water-and-sanitation-all
[9] UN, 2016: World Could Face Water Availability Shortfall by 2030 if Current Trends Continue, Secretary-General Warns at Meeting of High-Level Panel. un.org
[10] OECD, 2022: Financing a water secure future.

The initial investment universe consisted of around 5000 equities listed on European and North American stock exchanges. First, companies in the universe were screened based on their contribution to water-related solutions, where they were required to obtain at least 20% of revenues from either water infrastructure or water technologies.

Companies solely providing water or wastewater services (classic utilities) were deselected, but utilities focusing on the upgrade of existing and construction of new water infrastructure were kept in the basket.

Next, companies with severely unmanaged ESG-risks or exposure to controversial themes such as nuclear weapons or fossil fuels were excluded, keeping only companies that were assessed to do no significant harm to sustainability objectives. Then the companies in the basket were weighted to maximize the exposure to water-related solutions, starting with an equal weight for all and then adjusting so the weights reflect the water turnover share as well as liquidity considerations.

This creates a basket with a systematic overrepresentation of companies with a high contribution to the theme. Over 70% of total revenues contribute to solving water-related challenges. Our methodology is a departure from the normal way of constructing such indices, where weighting normally starts with a market cap basis before adjustments related to exposure are made.

As the last step, limits on the geographical exposure to specific regions were set to ensure diversification, leaving the basket with 65% exposure to North America and 35% exposure to Europe. The 19 selected companies are active within four different (GICS) sectors: Utilities, Industrials, Materials and Information technology.

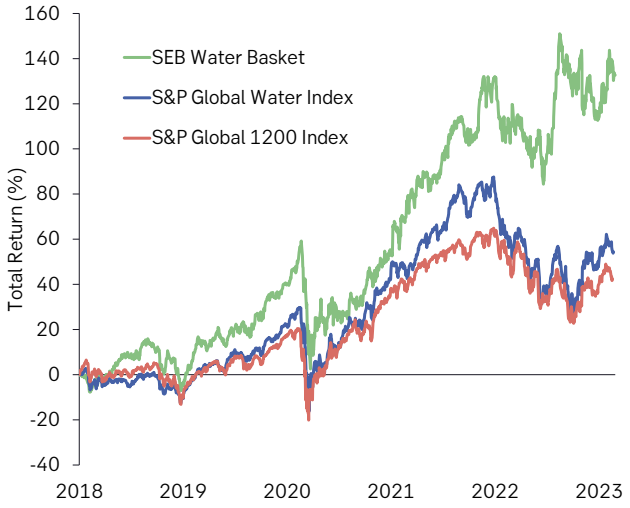
## Historical return of the water equities basket

Back tests are normally only of limited value, but this basket was constructed with no iterations and no intention to optimize for returns in the construction, so we think the results are a reasonable representation of the return from water-related investment.

The result of the back test is shown in Figure 22. The basket shows a clear outperformance over the past five years both compared to a broad market index and interestingly also to relative to the S&P Global Water index. The S&P Global Water index has also outperformed the broad index marginally over the same period, but with a much smaller tracking error.

This suggests that the excess returns are driven by of one of three things where it differs from the S&P Global Water index: a) the sustainability and classic utilities exclusions, b) weighting based on equal weight starting point c) the more concentrated exposure to the water-theme.

**Figure 22 Total return of SEB Water Solutions equity basket vs. S&P Global Water and Global Market Index**



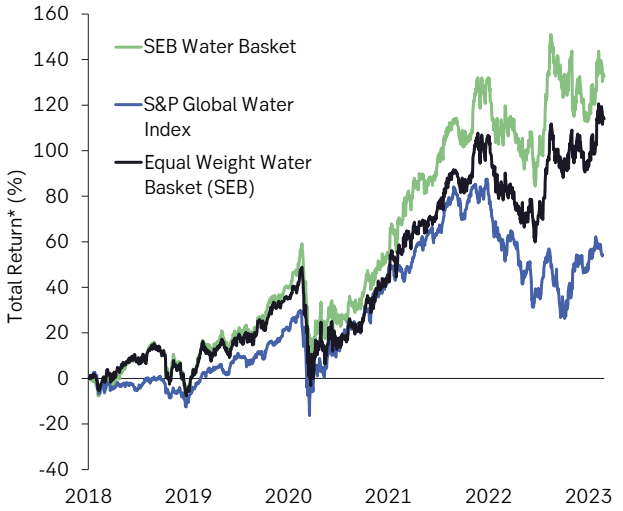

*01.01.2018-28.02.2023

Source: Bloomberg, SEB

To identify the source, we constructed an equal-weighted version of the basket, i.e. without the second layer of weighting according to the companies' water performance.

Figure 23 shows that a) and b) explain most of the outperformance – but not all of it, and especially in the most recent years there is a further layer of outperformance that must be ascribed to the more concentrated exposure to the water theme in our basket.

**Figure 23 Comparison of total returns**




*01.01.2018-28.02.2023

Source: Bloomberg, SEB

## Conclusion: water is worth a closer look

This analysis shows that concentrating the exposure to a sustainability theme like water and screening companies based on their broader sustainability performance would have had a positive effect on financial returns compared with both broader equity indices and broader thematic indices like the S&P Global Water index.

This is encouraging for investors looking to add exposure to the theme, although as always, past returns are no guarantee of future returns, and this is only a simple back test of the basket. Nonetheless, the results provide a reasonable signal of decent returns on top of the fact that you are investing in an area with potential to help solve one of our most pressing societal challenges

**Table 1 Portfolio characteristics**

| | **Sharpe-Ratio** | **Total Return** | **Standard deviation (annualized)** |
|---|---|---|---|
| | **5 Years** | **5 Years** | **5 Years** |
| **SEB Water Solutions Basket** | 0.97 | 145.94 | 23.78 |
| **S&P Global Water Index** | 0.57 | 61.56 | 18.91 |
| **S&P Global 1200 Index** | 0.42 | 41.6 | 18.03 |

Source: Bloomberg, Data as of 28.02.2023

# Towards a new economics of water

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## UN 2023 Water conference

On March 22-24, the United Nations General Assembly will host the first international summit on freshwater in almost 50 years. This is just one example of how water is rising fast on the global agenda. For good reason.

The UN 2023 Water Conference comes at a critical time. New research indicates that the global water crisis is worse than previously believed, and aggravates the triple threat of climate change, pollution, and biodiversity loss. Yet the world is unprepared, there is for example no global process or scientific panel tasked with addressing this fast-growing crisis.

The UN conference will not immediately change this, and it will not result in a negotiated new agreement. Formally, its role is to spur countries and actors to present new commitments for action and deliver on commitments already made, like the 2030 Agenda for Sustainable Development[11]. Nevertheless, it is a big step forward that international leaders meet to discuss global water issues for the first time since 1977 and it could set in motion a process where water is treated more like other major challenges such as the climate and biodiversity emergencies.

Expectations seem to be rising. One notable example was when 31 investors, including SEB Investment Management, issued an Open Letter to Governments on the Water Crisis in February[12]. "The global water crisis is a systematic financial risk to nearly all economies and the climate crisis multiplies these threats," the letter states, describing the UN conference as a "unique opportunity to tackle the crisis head-on".

The letter emphasizes that private financial institutions and governments each have a responsibility to act swiftly and boldly but laments that finance institutions are currently limited by "a lack of ambitious national and international water commitments", as well as insufficient public investment in solutions to address the crisis, and a lack of internationally aligned corporate water disclosures. The investors call on governments to "raise ambition and political will to solve the crisis".

## What is the global water crisis?

Many people find the global water crisis difficult to grasp even if they are confronted with a smattering of worrying statistics about the quantity and quality of the world's water. Often, the crisis is described in terms of water shortage, highlighting that 2.3 billion people live in water-stressed countries or that freshwater demand could be 40 percent higher than available supply already by 2030. Water pollution is also getting its fair share of attention, at least the plastic problem. There is less talk about the many unnecessary deaths caused by dirty water and the fact that most of the water used on a daily basis goes untreated into our rivers, lakes and the oceans.

Until recently, it was common to describe the various water problems as serious but separate challenges that primarily should be dealt with at the local level. But new research is increasingly emphasizing the global and interconnected nature of the water crisis. We are all dependent on the same hydrological cycle and when it is distorted by human activity, we are all at risk. In 2022, several reports showed

[11] https://www.un.org/sustainabledevelopment/development-agenda/
[12] https://www.cdp.net/en/water/open-letter-to-government-water-security

that this is now happening at an unprecedented and alarming scale:

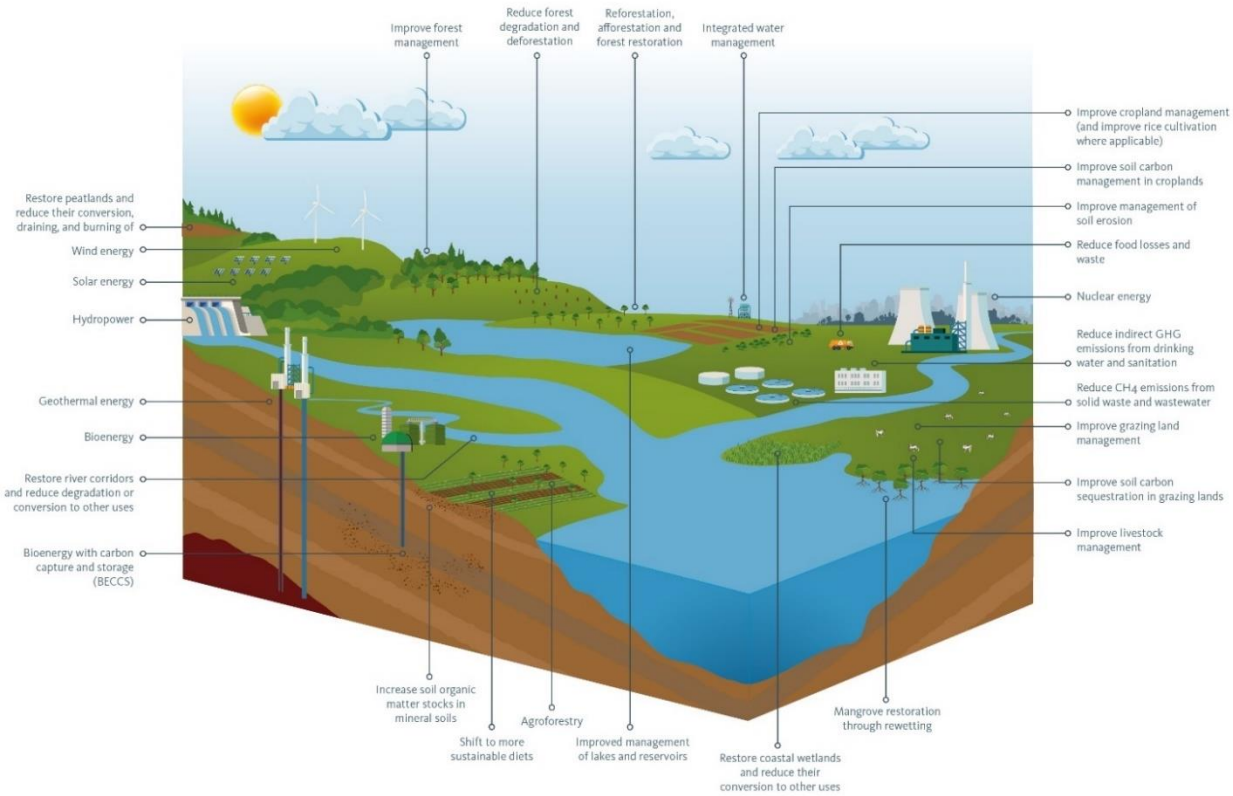
- **The planetary boundary for water has been crossed.** Scientists have warned that we must stay within nine defined planetary boundaries to keep Earth's natural support systems intact and the planet habitable for humans. Yet in 2022, two boundaries were officially crossed, for novel entities (e.g. chemicals and plastics) and freshwater. Human activities and climate change are putting so much pressure on the global water cycle that it is no longer functioning normally. We already feel this in the form of increasingly severe weather extremes like droughts, flash floods, and wildfires. Over time, this can make it more and more difficult to grow food, produce energy and lead the lives we are used to.
- **The role of water in climate change is much more critical than previously believed.** When the Intergovernmental Panel on Climate Change (IPCC) presented its Sixth Assessment Report in 2022, it became clear how much we have learned about climate change compared to the fifth assessment back in 2014[13]. One of the most significant shifts is that water is now very much at the centre of attention. The IPCC describes how changes to the hydrological cycle are triggered already by a quite modest increase in average temperatures and with more devastating consequences than expected. Another key take-away from the report is how nature's ability to sequester carbon seems to be weakening.

## Water as a lever for change

A closer look at the role of water in climate mitigation is taken in a new report, The Essential Drop to Net-Zero: Unpacking Freshwater's Role in Climate Change Mitigation[14], the first-ever summary of current research the topic.

It is the result of a project led by the Stockholm International Water Institute (SIWI) in collaboration with Stockholm Resilience Centre, the Potsdam Institute for Climate Impact Research, the German governmental cooperation agency GIZ, and UNDP. The report stirred great interest when launched at the climate meeting COP 27 in November 2022, since other studies on water and climate tend to focus on climate adaptation, not water's role in slashing in greenhouse gas emissions.

**Figure 24 The role of water for climate change mitigation**



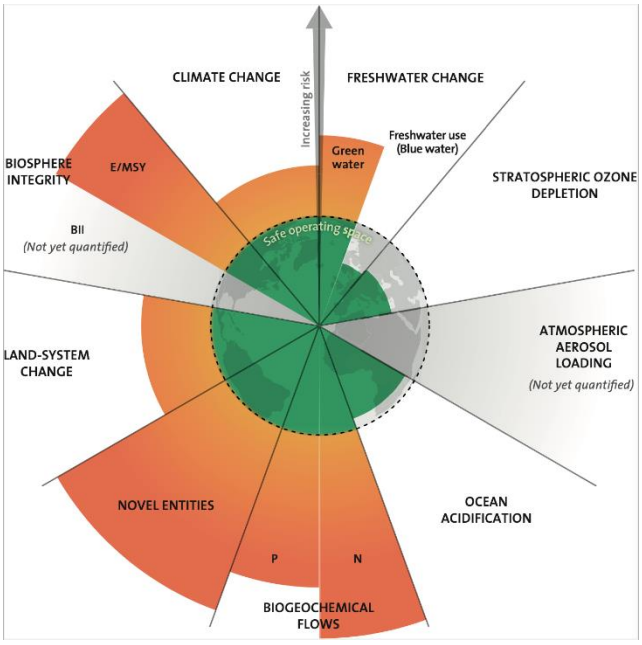

Source: SIWI

[13] https://www.ipcc.ch/assessment-report/ar6/

[14] https://siwi.org/publications/essential-drop-to-net-zero-unpacking-freshwaters-role-in-climate-change-mitigation-report/

The 40 researchers involved analyzed how water both impacts and is impacted by climate mitigation in a broad range of sectors, from land use and energy to wastewater treatment. One of the main lessons is that many climate mitigation strategies risk failure since they have not considered the impact on freshwater. Some fossil-free fuels may for example be too water-demanding for water scarce regions. Another lesson is that there is a strong case for investing in improved management of water and nature-based solutions that help mend the water cycle. The report identifies a range of actions that simultaneously increase nature's ability to sequester carbon, reduce disaster risks, increase groundwater recharge and offer other side benefits.

**Figure 25 Planetary boundaries**




Source: Azote for Stockholm Resilience Centre, based on analysis in Wang-Erlandsson et al 2022

## A new approach to water governance

Against this scientific backdrop, it is evident that all sectors of society will need to change how they manage water since current models are not suited for the future of unprecedented weather extremes and radical environmental change that lies ahead. At the same time the demand for water is increasing rapidly driven by population increase and economic development with energy production and manufacturing industry being the main water users by 2050. All this can also unleash a wave of innovation in water governance.

To move the needle, a Global Commission on the Economics of Water was launched last year and will present its first findings on 22 March during the UN conference[15]. The Commission is expected to transform our understanding of water economics in same way that the 2006 Stern Review revolutionized the thinking about climate and economics and the 2021 Dasgupta report sparked a new kind of economics related to biodiversity.

## Transforming the economics of water

CDP has warned that global companies in key industries are already losing billions as a result of the global water crisis, with USD 15.5 billion stranded or at risk[16]. There is a need for mandatory disclosures related to water across the whole value chain, which would help make reporting of nature-related risks more consistent.

But the risk lens is not the only valid perspective when exploring the relationship between water and business. Just as important is that companies and innovators take note of the new research about the role of water for climate, biodiversity, food production, and energy systems and turn this knowledge into innovations and solutions. This is one reason why the UN 2023 Water Conference and its Water Action Agenda should be an important source of inspiration for innovation in the business sector.

Some obstacles remain however and must be addressed. It is surprisingly difficult to find reliable data on the state of the world's water, for instance the level of pollution or how much grid water is lost every day. How water is valued is another area of concern, which can lead to over-consumption or mismanagement. World Water Week, the leading annual water conference organized by SIWI in Stockholm, will this year focus on water innovation to identify new solutions.

As demonstrated for example in SIWI's report about the role of water for climate mitigation, there is a strong case for nature-based solutions, improved wastewater treatment, and more water-efficient agriculture. There is also a strong interlinkage between water and energy.

When we understand these connections, we suddenly discover that a single water-centred solution often can help us solve more than one problem. Cities that restore wetlands can for example buffer against flooding, boost groundwater recharge, and store greenhouse gases while making the city prettier. This shift in perceptions is transformational and could mean that we are on the cusp of a blue innovation revolution.

[15] https://watercommission.org/

[16] https://www.cdp.net/en/research/global-reports/high-and-dry-how-water-issues-are-stranding-assets

# A neglected sustainability issue

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Just like the blood in our veins, water is what keeps the planet alive. This makes us susceptible to disturbances, also from a financial perspective. When AP7 recently conducted a preliminary assessment of nature-related risks in a global equity fund, two of the top three risks were water use and water pollution. And when climate change becomes more concrete, it will, among other things, be in the form of torrential rains, droughts, floods, and rising sea levels.

While water risks are evident, water is a key component of critical ecosystem services and thus an opportunity. Wetlands can, for example, balance weather effects and bind large amounts of carbon dioxide. They are also among the most biodiverse environments we have in Sweden. And for sustainable investors, companies that provide solutions to sustainability problems through water infrastructure, water treatment and water supply can of course be interesting investment opportunities.

The number of major ecosystem restoration projects can also be expected to increase over the foreseeable future as damages from extreme events become more frequent. These projects will need funding. In its State of Finance for Nature report from December 2022[17], UNEP assesses that by 2025 more than a doubling of the annual funding, which today stands at just over USD 1.5bn, is needed for projects involving water to restore natural capital.

## Water is deprioritized sustainability issue

Water is an urgent issue for investors both as a financial risk as well as an opportunity to create returns and solve sustainability problems. Unfortunately, water issues still do not receive the attention they deserve. For more than a decade, the World Economic Forum has ranked water risk as one of the most serious risks causing severe economic and social costs already today. Nevertheless, the issue has not entered the financial industry's consciousness in the same way as climate and more recently biodiversity.

When AP7 started an in-depth theme on fresh water[18] in 2016, we found that the companies did not prioritize water issues either. It was even the case that vulnerable industries had developed a lot of work on water issues for practical reasons, which they did not bother to report. The demand for ambitious water reporting was simply too low.

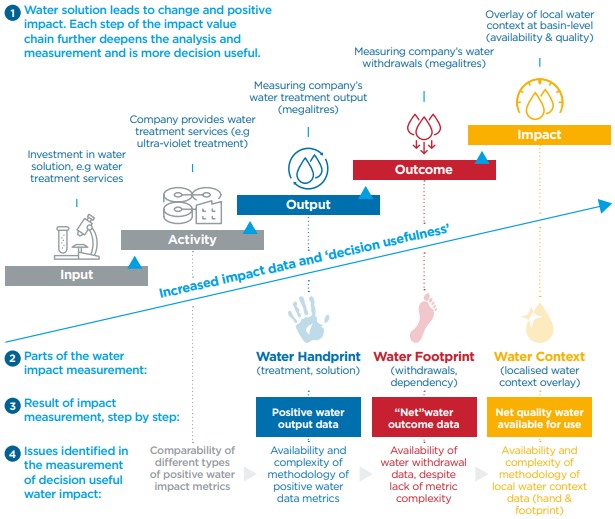
In a study AP7 did together with Impax in 2021[19], we found that there are few global frameworks for measuring water impact that capture all the necessary elements to provide a comprehensive picture. The measurements are almost entirely focused on water quantity, while information on water quality and pollution is conspicuous by its absence. In 2020, CDP did a survey that showed that less than 5 percent of the companies reported on water quality targets[20]. The local context is also missing, even though it is crucial for understanding impacts related to water quality.

Global standards are needed for sustainability reporting in general and for water reporting specifically. Improved measurement and reporting could inform investors' decision-making on everything from physical water risks and investment opportunities to companies' resilience to

[17] UNEP 2022 State of Finance for Nature
[18] AP7 2019 Themarapport vatten
[19] AP7 and Impax 2022 Improving measurement of Impact in listed equity: Water Case Study
[20] CDP 2020 Global Water Report

water-related climate risks. But a prerequisite is, of course, that investors demand the information.

**Figure 26 Value and impact of water activities**




Source: Impax and AP7

## Policy reform is needed

Just as with climate change, all parts of society need to work together if issues surrounding the management of water resources are to be solved. " There is a water crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people - and the environment - suffer badly," writes the World Water Council[21].

Like biodiversity, water is often not valued as a scarce and valuable resource, leading to overuse and underinvestment. In Sweden, investments in the water and wastewater network will have to increase by many millions annually in the coming decades. Paradoxically, the market's demand for green and blue investments has so far been greater than the supply of investment opportunities. This situation led AP7 to initiate a review of the barriers to increased water and sewage investments in Sweden in 2017 together with a group of Swedish investors within the SIDA Swedish Investors for Sustainable Development (SISD) network[22].

One of the barriers that was identified was a resistance among the decision-makers to raising water service tariffs, which is necessary as water and sewerage operations according to the Water Services Act must be municipal and self-financing. Revenue cannot exceed costs and in practice private ownership is not possible. At the same time, the review showed that the decision-makers also hesitated to increase the loan burden in the municipalities, despite the low interest rates prevailing at the time. Nevertheless, debt financing is necessary to manage the maintenance debt in the water and sewerage network as long as water rates are to be kept down. Without either increased fee collection or maintenance loans for water and wastewater projects, there will be no maintenance and no investment opportunities either. Instead, the maintenance debt continues to increase.

The problems in the Swedish example are not unique to our country. There are many examples of similar problems around the world. Basically, it is about finite natural resources that are not priced and that are overexploited, which, among other things, is pointed out as a main problem in the Turning the Tide report that The Global Commission on the Economics of Water released this March[23].

## Glimpses of light

Despite measurement and reporting challenges and a focus on negative impacts instead of positive opportunities, the commitment to water quality and biodiversity is gratifyingly growing both nationally and internationally. The EU's Water Framework Directive proposes stricter restrictions on wastewater and limits on agricultural runoff to tackle eutrophication. The Baltic Sea, with seven of the world's 10 largest marine dead zones, has become the first "macro-region" targeted by the EU. A new international sea treaty also means that protected areas will be expanded to 30 percent of international waters by 2030[24]. Conditions for marine life will be improved by restrictions on fishing, shipping and mining activities. At the same time, the first UN conference with a water focus in almost 50 years is now being held to increase the pace and get the necessary measures in place.

In this context, companies with solutions to improve water quality can benefit from the developed regulatory framework and help solve problems. As in many other areas of the economy, the digital revolution is opening up new opportunities for water investment. Measuring and reporting water impacts would provide investors with useful information to manage water risks and highlight the positive effects of water solutions.

The situation is an opportunity for those who want to get ahead. The first step for investors is better information.

[21] World Water Council 2000 World Water Vision
[22] Svenska Kyrkan, AP7, AP3, Skandia and SPP 2017 Förstudie: Vatten som investeringsobjekt
[23] The Global Commission on the Economics of Water 2023 Turning the tide
[24] UN 2023: Draft agreement under the United Nations Convention on the Law of the Sea on the conversation and sustainable use of marine biological diversity of areas beyond national jurisdiction

# No water – no beer

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## Carlsberg's industry leading water-related record and targets

Protecting water resources is essential for Carlsberg Group's business and for the communities where we operate. Water is not only a key ingredient but is also used for cleaning and production processes at Carlsberg breweries – and to grow the hops and grains used to make high quality beers. Since 2015, Carlsberg has cut the amount of water used from 3.6 to 2.5 hectolitres (hl) for every hl of beer produced around the world. That is a 31% reduction, beating our 25% target for 2022 and making the company one of the most efficient major brewers in the world. By 2030, the aim to get this down to an industry-leading 2.0 hl/hl globally.

Further Carlsberg also safeguards water supplies for local communities in high-risk areas through local partnerships. We have also set an ambitious new goal to replenish 100% of the water consumed in high-risk areas by 2030. Water is essential to keep breweries going, and at Carlsberg we recognize that we have a responsibility to use this vital natural resource in a way that does not compromise water supplies for the communities around us – especially in regions at high risk of water scarcity. The best way to do this is to make our breweries as efficient as possible to prevent water being wasted, and to reuse water where we can and to support local communities in high-risk areas.

## Understanding water risk

Carlsberg is also evaluating their overall water risk using WWF's Water Risk Filter tool based on four weighted parameters.

One third of the score is allocated to water risks within a given river basin as a whole and one third to operational risks for the industry. Each of these two standard parameters is based on a holistic view of:

- Physical risks associated with water scarcity, overabundance, and quality of water, as well as degradation of related ecosystem services; regulatory risks, based on good governance in line with UN Sustainable Development Goal target 6.5 and the Organisation for Economic Co-operation and Development (OECD) water governance framework
- Reputational risks related to cultural attitudes, media coverage, trust and conflict

The final third of the score is split equally between two tailored parameters that are specific to each Carlsberg brewery: its current size, based on production volumes; and its growth projections.

Based on Carlsberg's latest analysis, none of Carlsberg's breweries have any overall operational risk from water shortages. However, 16 of them – and one associate – have been defined as high-priority sites. These high-risk breweries are located in nine different river basins across Cambodia, China, India, Laos and Nepal, and the ambition on these high-risk breweries is to have an even more water efficient production by targeting an efficiency of 1.7 hl/hl in 2030.

Carlsberg has also used WWF's ground-breaking water scenario analysis tool, where we have modelled water risk scenarios in 2030 and 2050 based on current trends, as well as both optimistic and pessimistic pathways. This showed that breweries at highest water risk today are generally the same ones projected to experience the greatest increase in risk in all modelled pathways.

Going forward, we will be using our current actions, insights from our stakeholders such as WWF and new technologies to ensure that we continue our journey towards ZERO water waste. We do so to ensure that we reduce risks and

capture opportunities of introducing sustainable water practices across our breweries.

## Case story: Halving water usage at Fredericia brewery in Denmark

In 2021 Carlsberg inaugurated a new, revolutionary water recycling plant that recycles 90% of the process water at the Carlsberg brewery in Fredericia, Denmark. The plant in Fredericia is built on a new and innovative approach to cleaning and recycling process water where you, among other things, use UV-light to eliminate bacteria. At the same time biogas is produced as a residual product, which can be used to produce energy. It is a whole new form of circularity in food production. In fact, the process water ends up being clean enough to drink, but today is the water only used to clean the production facilities.

The new water recycling plant saves more than 500 million litres of water a year and the water consumption will be halved from 2.9 hl of water per hl of beer to 1.4 hl of water for all beer production at some instances in the year. This makes the Fredericia brewery the most water efficient in the world. Learnings from the brewery will enable Carlsberg to reach its target to virtually eliminate water waste globally by 2030.

**Figure 27 Carlsberg's brewery in Fredericia**

Source: Carlsberg

# Strong potential in Nordic decentralized small-scale hydropower for sustainable local electricity supply

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## Small scale hydropower plants key to building a cost effective and robust local energy system

The recently launched Article 9 fund, SEB Nordic Green Energy with focus on renewable energy production, is investing into existing small-scale hydropower plants (HPPs), an often ignored but potentially powerful source of generating more local electricity before 2030. Electricity output can often be doubled, or at least improved by 30% , through upgrading to new technologies and ways of working. The plants are habitually located in proximity to local demand and vital to stabilize the energy system at peak loads.

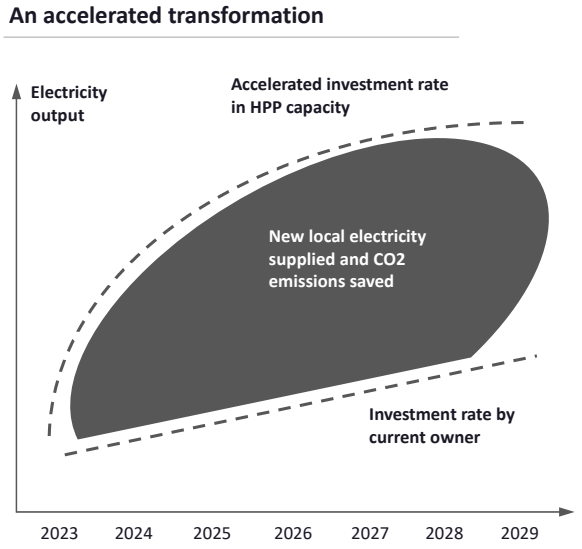
Beyond being a pure zero emission source, the smaller scale hydro power plants are in essence a key to building a cost effective and robust local energy system. As part of an island-mode design, they are essential to a self-sufficient local energy system that can withstand external crises. Also, hydropower is embraced by consumers and citizens as one of the most accepted energy sources. And public acceptance will be one of the most important features of getting new generation capacity in place to secure increased demand.

## Hydropower – a key enabler in the building of the modern Nordic welfare state, yesterday and tomorrow

Where can we find the energy sources that already in the short run, and backed by public acceptance, can contribute to a more sustainable, efficient, and robust local energy system without long planning and regulatory processes? While many new projects are hampered by either the complexities of yet not fully proven technologies, the need to claim virgin land or sea or public resistance; existing small-scale hydropower has none of these challenges.

Hydropower is since the early 1900's the predominant electricity source in the Nordic countries except Denmark. Hydropower was a key driving force behind the electrification and industrialization in the early 1900's and thus a cornerstone in the building of the modern Nordic welfare state. Hydropower today delivers more than 90% of the Norwegian, more than 40% of the Swedish and over 20% of the Finnish electricity mix. As a zero-emission energy source, hydropower is the main reason behind the sustainable energy mix in these countries. Besides, hydropower is also unique in its ability to deliver both base load and peak load capacity to the grid.

**Figure 28 Benefits of an accelerated investment into small scale hydropower plants, illustrative**




Source: Locus Energy/SEB Nordic Green Energy

## The electricity potential in small-scale

Norway, Sweden, and Finland have altogether some 4,000 hydropower plants (HPP's). The majority of the hydro power at national level is generated by a few larger HPP's . This has led to the smaller scale hydropower plants being overlooked in the discussion of how to tackle the challenge of increased electrification.

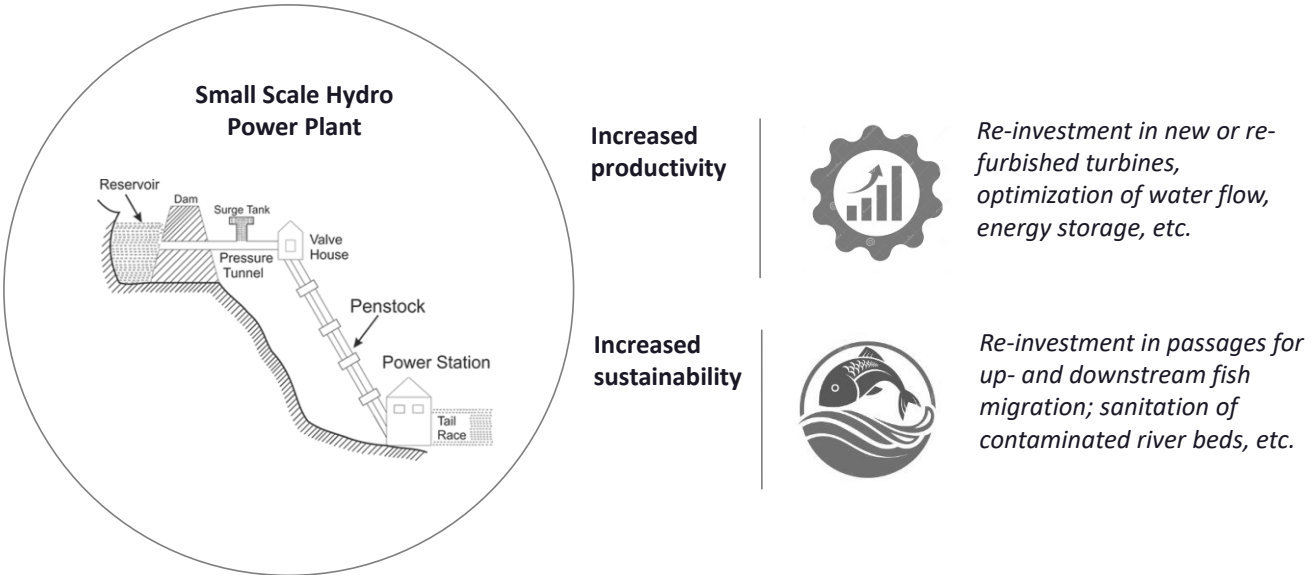
However, the many thousands of smaller plants scattered all over Sweden, Norway and Finland constitute a vital and often system-critical electricity source at local level. Furthermore, most of these plants were built many decades ago with old technologies, are still operated in a traditional way and have a huge unexploited potential.

By upgrading these already existing HPP's with, e.g, improved re-furbished turbines, better optimized steering of water flows and storage through batteries, their electricity output capacity can be considerably improved while at the same time living up to strengthened environmental conditions. Further, by being a decentralized source of electricity, these small scale decentralized HPP's can be a part of a cost-effective solution of the widely discussed distribution constraint issue.

"Today, small-scale hydropower caters to 17% of required electricity capacity at peak load hours during winter in areas like Southern Sweden. The good news is that around 80% of the small-scale hydropower plants are underexploited and can generate about 30-100% more electricity, sometimes significantly more and without the need to claim any additional eco-system resources. The small scale HPPs are indeed a powerful tool to achieve an effective, sustainable, and resilient local energy system", says Niklas Sörensen, CEO & Senior Partner at Locus Energy, one of the partner companies to SEB Nordic Green Energy Fund.

Many or even most local communities today have a negative electricity balance, where electricity demand from local industries and households by a multiple exceeds local electricity generation. The problem most often occurs at peak load hours, when not enough power can be supplied to factories and households. In extreme cases this can lead to blackouts which – even if counted only in seconds – lead to several days and weeks of disturbed industrial processes. This is also a situation which hampers new industrial investments and expansions. To wait for new national grids and new centralized large-scale electricity generation capacity associated with extensive regulatory processes simply takes too long. Therefore, this makes solutions where new electricity can be generated from existing local plants highly interesting.

**Figure 29 Schematic picture of small scale HPP and examples of measurers to restore ecological qualities and technical upgrades for increased productivity**




Source: Locus Energy/SEB Nordic Green Energy

## New environmental requirements for hydropower plants – an opportunity

While being a zero-emission source of electricity and - as in the case of the upgrading of existing HPP's – being close to zero embodied carbon, the HPP's however have an impact on the local ecosystem that needs to be accounted for.

Citizens, nature, and industry all need clean rivers and lakes, groundwater, and bathing waters. The EU Water Framework Directive is the main regulation for water protection in Europe. Its main objective is to protect and, where necessary, restore water bodies to reach good chemical and ecological status, and prevent deterioration.

Currently and until 2040, all Swedish HPP's are reassessed under the Environmental Code and step by step upgraded to modern environmental requirements. This reassessment intends to ensure that all HPP's meet the new environmental standards, while at the same time safeguarding local energy supply. The outcome of this process thus leads to a plan for every plant that contains various measures to ensure ecological quality and biological diversity such as, e.g., the required upstream and downstream migration of fish. As a side effect, the local eco system can also be improved in other ways, such as by sanitation of previously decontaminated riverbeds caused by former industrial activities

Today, these measures to restore the ecological qualities of rivers can go hand in hand with technical upgrades of the HPP's. Through a holistic re-investment plan, the plants can be equipped with upgraded technology that pro-longs the lifespan of the HPP both from an ecological and an economic perspective.

## Local robustness – increased self-sufficiency

Several factors in combination, including increased geopolitical instability, threats of military conflicts and increased risk for natural disasters including storms and flooding due to the climate effect, has led to many local communities and villages identifying the risks of being too dependent on centralized solutions when it comes to society critical functions such as electricity supply.

**Figure 30 Small scale HPP in southern Sweden**

Source: Niklas Sörensen

Also, many business sectors such as manufacturing and logistics have identified similar commercial risks in being too dependent on global supply chains and seek to relocate part of industrial activities to local community level and closer to consumers. Therefore, many communities have ambitions to be able to occasionally be able to operate independently to the national grid, commonly known as "off-grid" generation or 'island-mode'. A typical target can be 10-15% local self-sufficiency of electricity generation. Also, here the local small-scale HPP's can play a vital role together with e.g., battery storage.

## Build-up of a Nordic portfolio of small-scale hydropower

The SEB Nordic Green Energy fund together with its partner Locus Energy is currently building up a portfolio of, small-scale HPP's. The portfolio structure will enable a cost-efficient operation of the plants while also enabling a significantly more powerful re-investment plan to harness the electricity potential of each facility while also upgrading to new environmental standards

To the many local communities around the Nordic countries, that are in an emergent need for increased and decentralized electricity supply, the small scale HPP's be an important contributor to building a more capable, sustainable, and resilient local energy system. And within a significantly shorter time frame than with other solutions.

## Disclaimer

SEB Nordic Green Energy Fund | SEB (sebgroup.com).

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# Exploring water innovation: Interview with start-ups providing sustainable water solutions

Introduction by Karina Barquet, PhD
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Over 700 million people globally still lack access to electricity, according to the UN. Additional 2.5 billion people lack access to clean cooking methods, 2 billion lack access to safely managed drinking water, and 3.5 billion lack access to safe sanitation.

Meeting these needs by relying only on traditional grid-based systems is impossible and costly. The increasing demand for humanitarian assistance and the impacts of climate change, globally – whether in Nyköping or in Nairobi – further underscore the growing need for fast solutions, off-grid. And in an era of ageing infrastructure, these solutions are likely to fill the demand for massive and rapid investments in the coming decade. Getting solutions in place will require innovation from the private sector, in collaboration with public sector, development organizations, and academia.

So far, the pace of change is too slow. While it is well-known that business models and product development processes are not sufficiently adapted to the contexts in which products are launched, our experiences suggest that the specific stages or characteristics that make a decentralized product or service successful in such contexts, are less well understood by organizations and private sector actors interested in operating in the humanitarian and development fields.

Through the sWASH & grow project funded by Vinnova (Swedish Governmental Agency for Innovation Systems) and co-funded by the Gridless Initiative, the Stockholm Environmental Institute worked together with seven promising solutions developing off-grid products. In this article, you have an opportunity to learn more about three of them.

## Ecobarge

*Interview with Mårten Björk, Founder*

**What inspired the creation of your company?**
The Ecobarge concept is a combination of what I was involved in before. From childhood, growing up in a Lions Club family, raising funding for poverty reduction for making a difference until becoming a serial entrepreneur.

During many years I was the CEO and shareholder of S-Man Heating Systems, a disruptive "gazelle" company within marine heating systems, focusing on the marine and offshore markets world-wide. As one of several niches, we co-operated with and acted as suppliers to Turkish entrepreneurs within floating powerplants.

Another inspiration was the successful business model of Elpanneteknik Sweden AB, where I have acted as one of the founders, CMO and chairman. The company provide emission free high voltage electrode steam and hot water boilers for industrial and district heating, thermal energy storage and electrical grid frequency balancing. The founders of Elpanneteknik were able to scale the start-up company through organic growth and positive cashflow until our recent exit to a listed company by incorporating Build Own Operate business model towards end users, selling hot water rather than electrical boilers. I was humbled and honored to become a finalist in the Entrepreneur of the Year in 2018 as nominated by SEB for our achievements with Elpanneteknik.

**How does your solution work and how does it stand out from others?**
Ecobarge are modular, scalable, financed floating platforms integrating sustainable technologies to meet the

needs of specific users. They are climate resilient, and can operate in harsh weather, such as typhoons.

For the end users, we deliver a "turn-key" fully financed solution meeting their needs. We focus on providing potable water, cooling of fish, renewable energy, and charging infrastructure, but in principle we can integrate any technology. Through the Build Own Operate Transfer model, local entrepreneurs are employed, educated, and become minority shareholders in the project companies owning and operating the assets. Once majority investors exit, they can keep the means of production.

For the project investors we provide unbeatable returns on sustainable investments and better security. For the innovation companies, we provide the opportunity for financing through positive cashflow. As a client and contractor, we integrate their innovations with what can be produced locally into turn-key solutions meeting the needs of local end users world-wide. As a supplier we can also provide sales and marketing, sourcing, maintenance, and operation of their plants. We are good in developing "bits and pieces" in Sweden, but end users need fully financed services provided. Ecobarge acts as fully financed testbeds and pilot plants world-wide for scaling innovations.

**How is your company financed?**
Trough organic growth and by inviting project financiers into the project companies created on a one-by-one basis.

**What are your main challenges and how do you plan to overcome them?**
We have more inquiries than we can quote for. The technologies are ready and available, and we have no problem with raising project financing, even for the projects in conflict areas, such as Ukraine and East Africa.

The main challenge is financing the local pre-feasibility studies to identify the needs of the end users and prove the business cases to investors on a project-by-project basis. Project financiers prefer to compete in projects that present them with finalized "bankable" business cases, rather than investing already at the pre-feasibility stage, even though by financing the pre-feasibility, they can receive a discount on the financing they later need to provide for being allowed to invest into the projects.

Nevertheless, our business model allows us to use the proceeds from selling and operating plants for investing into pre-feasibility studies. With time, we become more cost efficient in performing pre-feasibility studies and can cover these costs. It seems to become a business opportunity in and of itself to sell projects including pre-feasibility studies to investors.

## IngesonWater

*Interview with Rolf-Johan Ingeson, CEO*

**What inspired the creation of your company?**
My father, Rolf Ingeson is the inventor of the water purifier "Millennium Desalination Device". He received 2011 "Skapastiftelsens diploma" in memory of the inventor Alfred Nobel and 2013 he won the prize as the "inventor of the year" in Södermanland Sweden.

The company IngesonWater, originally named Millennium Technology of Sweden, started in 2011. The "spark" that ignited this work was the urge of making a difference for the hundreds of children who die every day due to lack of clean water, according to UN, and the problem for many people around the world, to access clean, safe water, despite of all the unusable saltwater surrounding the globe.

At an early stage, Rolf got a clear vision of how a desalination machine should work, which was then validated by various patent engineers. This resulted in a rapid development of 40 patents worldwide. Over the years, we have developed 4 prototypes and we are today ready to take on the market.

**How does your solution work and how does it stand out from others?**
Our innovation in water purification uses well known technology combined in a new unique way. The physical principles which the machine is based on are heat, rotation, vaporization, and ionization. All these principles work together in a unique way to make the water purification process more efficient and environmentally friendly than many other technologies on the market. For example, we use no membranes, filters, or chemicals, which means that the process is 100% environmentally friendly. The fact that we use titanium throughout our machine means that we have a sustainable concept that can withstand tough environments over a long period of time. Another important aspect is that all raw water is processed and purified, which means that we have minimal water loss where our competitors in most cases have a lot.

**Figure 31 IngesonWater water purification technology**

Source: IngesonWater

In 2023, we are in a new phase where we will deliver our first machine to a customer and can apply our business model, which consists of selling water per liter. A closer look at the profit and loss calculations shows the power of selling the water produced compared to selling machines. We have a unique product that can make a big difference in many areas within the Agenda 2030, including poverty alleviation, increased health, democracy development, and increased gender equality.

**How is your company financed?**
Today, we are largely financed by grants, equity capital, loans, share contributions and project funds. Funding has been an incredibly tough nut to crack during the development period, but we are extremely grateful for the support we have received from, among others, our shareholders who have contributed to the positive development we have had during these years.

**What are your main challenges and how do you plan to overcome them?**
Perhaps the most significant challenge is finding a sustainable financial situation that guarantees safe development, together with necessary organizational development. As mentioned above we have many international markets covered by solid patents, markets waiting for profitable start up.

In Sweden, issues connected to water supply historically have not been prevalent. However, today water has become a central topic for many, even here in Sweden. Especially with the ongoing war in Ukraine where we understand that we need to be more prepared for possible crisis situations in the future. Internationally, the interest has been great all along and we have many requests from different countries, both in the context of crisis and disaster equipment, but also general development.

## Pure Bio Synergy

*Interview with John Nyberg, Founder and CEO, and Carl Crafoord, Business Coordinator*

**What inspired the creation of your company?**
I have always been an entrepreneurial type of person with a deep love for the planet, and when I got in contact with the innovators (behind our now patented core component) I got very enthusiastic and interested. The driving force was to create something that could help cleaning up human and industrial waste. I have had an inner continuous motivation to work with this since

**How does your solution work and how does it stand out from others?**
It is basically a robust, high quality ozone generator. Ozone (O3) is one of the best and most effective "cleaning agents" known to science. It is created from the oxygen in the air by passing it through our high voltage (corona discharge) reactor and after the work is done it breaks down to oxygen (O2) again. It's a zero-sum game with oxygen atoms. The only thing that's added is electricity.

Our ozone generator is off-grid adapted and, and unlike conventional ozone generators, it can be fed with humid air (any humidity, even water). This means it can be run in harsh, humid, and complex environments, such as on the field in a tropical country, but also in demanding and special industrial applications. Our product is typically used for disinfection of materials and surfaces, as well as for cleaning and disinfection of air and water.

**How is your company financed?**
Initially, it was me and the first group of shareholders. A big deal of bootstrapping. From 2015-2016 we got a lot of help/subsidized cost from a local "incubator" and from the the Swedish government. In 2017, an early customer of a pilot system – Carl Crafoord – became the company's first investor/business angel and is still PBS's biggest financier today. We have along the way also attracted other semi-big investors and gotten public funding (Vinnova-projects). In addition to this we have loans from Almi and from our bank.

**What are your main challenges and how do you plan to overcome them?**
One main challenge is, unsurprisingly, finances. We are planning to overcome that through going from developing company to commercialized business. We also sometimes need to "educate" our clients/the market a bit, so they understand that ozone can now work even where it perhaps has not worked before.

**What has been the most challenging part in getting access to capital?**
The commercial dialogue. To be able to explain the potential market and "boil down" all possibilities to a credible sales forecast. Especially since we are breaking a new market segment where other ozone producers have difficulties to operate in an effective way.

**Figure 32 The "(H)unit" ozone generator**


Source: Pure Bio Synergy

That being said, it is not the ozone market we operate in. It is safe water and safe disinfected surfaces and that market is huge. So, we have to narrow it down to something

understandable and possible to count on. At this stage, we have interested customers in four completely different segments:

- Cooling/storage rooms to reduce microbiological growth
- Keg disinfection
- Safe water in crises and catastrophe
- Reducing microbiological growth in cooling towers

We can use our core product – the ozone generator "(H)unit" – in all of these four areas. All it will require is some adaptations, with off-shelf components, tailored for the specific client and adaptation. This means, that we can create volume and cost advantages in our own product and use it in different markets.

# Denmark aims to double export of water technology by 2023

MINISTRY OF FOREIGN AFFAIRS OF DENMARK

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Water is one of the world's most important natural resources and access to water is essential for a good life. However, water is also a part of some of the biggest global challenges. Such as, for example, problems with access to clean water, flooding and dealing with untreated wastewater in a sustainable way. Danish companies are among the global leaders when it comes to water technology and water solutions, and their solutions can contribute to solving the global challenges.

## Denmark's Export Strategy for Water

For Denmark to continue contributing to the fight against climate change and support the global green transition, it is important to pool efforts and share the responsibility. Therefore, Denmark's Export Strategy for Water was launched in November 2021 by the Ministry of the Environment, the Ministry of Foreign Affairs and the Ministry of Business, Industry and Financial Affairs in close partnership with the water sector. The strategy sets a united framework for Danish export efforts within water technology for the years to come.

Lars Løkke Rasmussen, Minister for Foreign Affairs: "Water is among our most important resources. We all need clean water. Denmark has been a global frontrunner within advanced water technology for decades and our sustainable solutions can significantly reduce water loss, energy consumption and CO2 emissions in all parts of the world, addressing the severe global challenges with water and climate adaptation".

The strategy's vision is that the Danish water sector helps solving the world's water and climate adaptation problems. More specifically, it sets the goal of doubling Danish export of water technology and services from 20 billion DKK in 2019 to 40 billion DKK in 2030. To support this vision, a number of initiatives has been established and the strategy contains a large number of strategic efforts. Among these are an export scheme noting that the Ministry of Environment and the Ministry of Foreign Affairs enter into government-to-government collaborations in the USA, Germany, Italy, Poland and Spain with posted water specialists to both run the collaboration between authorities and assist Danish water companies in local projects. The Danish Environmental Protection Agency contributes knowledge in the regulatory area. Moreover, a water specialist is posted in India to support Denmark's Green Strategic Partnership between India and Denmark. In addition, the strategy is supported by financial tools such as the establishment of EKF's Green Accelerator facility and Green Advisory Pool, to help the financing of Danish water specialists' export activities (eg. water utilities).

The strategy has been created in a public-private partnership with various partners in the water sector, such as DI WATER, Danish Export Association, CLEAN Miljøklynge, Dansk Miljøteknologi, DANVA and State of Green together with The Ministry of Foreign Affairs, the Ministry of Environment and the Ministry of Business, Industry and Financial Affairs. Furthermore, over 40 companies participated in workshops to narrow down the strategies' needs and framework to meet the demand from the private sector. In order to decide which markets to focus on, an external evaluation was made where over 75 companies were asked about their export barriers and in which market they saw the biggest potential.

One of the efforts in the strategy is the creation of Forum for Dialogue, a focus group of the partners behind the strategy. Forum for Dialogue meets four times annually to discuss the initiatives in the strategy, coordinate upcoming export activities, and get a status on the export of water and environment technology.

## Case example: Water Technology Alliance US

The Trade Council, under the Ministry of Foreign Affairs, leads a strategic sales alliance in the US. The alliance is called Water Technology Alliance US (WTA) and consists of a team with highly specialized technical advisors, often from Danish utilities, who foster a peer-to-peer technical dialogue with local stakeholders and commercial advisors who support the dialogue and secure the commercialization of a potential project. The alliance is currently working with 13 Danish companies and collaborates with Danish utilities and the partners behind the Export strategy for Water.

The US Water Alliance, the Embassy of Denmark in Washington, and the Danish Water and Wastewater Association (DANVA) announced and signed a new Memorandum of Understanding (MoU). The US Water Alliance is an organization consisting of the largest and most ambitious American water utilities and is one of the most influential lobby organisations at federal level.

The agreement aims to promote cross-cultural learning on climate mitigation strategies to reduce greenhouse gas (GHG) emissions across water management and operations.

The partnership will ground the peer-learning cohort in cross-cultural knowledge exchange and collaboration to advance shared goals of a climate secure future and resilient global water sector. By learning from Danish counterparts, utilities in the US will have access to additional expertise, ideas, and strategies being implemented in real-time. The Danish water sector is already well on its way to reaching a climate-positive and energy-neutral water sector by 2030—targets that support the Danish government's strategy to reduce GHG emissions by 70 percent in 2030.

**Figure 26 Representatives of the Danish government on a site visit**

Source: Ministry of Foreign Affairs of Denmark

As part of the partnership, WTA US invited American professionals from 10 leading utilities to Denmark on a delegation trip. The aim of such delegation was to showcase Danish technologies and the way they support the green transition and hence contributes to the ongoing dialogue. The partnership has already proven fruitful, and a handful of Danish companies have been positioned in upcoming tenders.

# How IFAD is tackling with the nexus of water, agriculture and food security: urgent investment needs


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## Efficient use of water resources essential for rural populations and agriculture

Water and Food systems are deeply connected; urbanisation, population growth, unsustainable agricultural practices and weak governance are just some of the factors driving increased demand and often the misuse of critical food and water resources. The efficient use of water resources, especially for the poor rural population, together with the transformation of food systems have become essential to meet current and future demand in an inclusive and environmentally sustainable way, and thus achieve the Sustainable Development Goals and the Paris Agreement targets.

Agriculture is the largest consumer of the world's freshwater resources, so building resilience into water and food systems has emerged as an important policy priority and governments must ensure integrated and sustainable management of water, food and energy to balance the needs of people, nature and the economy. The International Fund for Agriculture (IFAD) integrated water-food-energy approach and holistic perspective directly advances both energy, food security and sustainable water resources management, while contributing to job creation, gender equality and climate action.

## IFAD is supporting communities globally

IFAD has been a major development partner in the water sector at the smallholder level. About 13% of the current IFAD-supported investment portfolio is devoted to the rural water sector, for a total of USD 2.85bn and 20% of international co-financing is devoted to water. About 70% of IFAD financing for water is dedicated to irrigation development with resources of USD 1.46bn going to local climate-resilient interventions; 9% for mitigation and 91% for adaptation. Among IFAD's significant achievements, it has empowered approximately 46,400 groups around the world and built and rehabilitated water infrastructure serving nearly 600,000 hectares of agricultural land. Around 220,500 rural households worldwide learned new climate smart practices through the IFAD-supported projects and increased their resilience to climate change. Moreover, around 162 tons of greenhouse gas emissions (tCO2e) were avoided and/or sequestered. IFAD has also rolled out renewable energy activities with smallholder farmers in 23 countries, powering smallholder agriculture with renewable energy. The Adaptation for Smallholder Agriculture Program (ASAP) has introduced energy-efficient processing and storage technologies such as solar heating, cooling, drying and energy-efficient appliances in 15 projects, including in Mali, China, Mozambique, Rwanda, Kyrgyzstan and India. An IFAD USD 2.2 mn grant for solar refrigeration technologies in sub-Saharan Africa has reached over 10,000 beneficiaries. IFAD has also facilitated the deployment of improved cook-stoves and biogas digesters in Bolivia, Mali, Nigeria and Kenya, benefiting more than 620,000 small-scale rural families.

## But is that enough in a rapidly changing world with population growth, resource depletion and climate change?

Through IFAD's unique focus on the rural poor, our work at the smallholder level ensures that the most vulnerable to climate change and water scarcity have access to the means, the knowledge and organizational settings, they need to eradicate poverty and hunger. Take for example the Butana region in eastern Sudan. In recent years rainfall has become unpredictable and both farmers and herders

have limited access to irrigation schemes or permanent water sources; the area's natural resources are under growing threat from outside interests, such as large-scale commercial farms and artisanal goldminers. Local people struggle to exercise their right to manage their natural resources, especially around the use of shared land or regulating access to water. The IFAD-supported Butana Integrated Rural Development Project (BIRDP) introduced a framework for local people to govern their natural resources by identifying their priorities and constraints through dialogue with government agencies. Using the framework, local communities have built village networks to manage resources equitably and protect their landscapes. They've resolved internal conflicts over resources and come together to prevent the exploitation of their land by outsiders.

**Figure 3334 IFAD project in Africa**

Source: IFAD

## Scaling investments in rural prosperity and sustainable resource management

Farmers around the world face many such barriers, often combined with limited access to finance, value chains and affordable technology such as irrigation equipment. Carefully planned business cases can show farmers how to overcome these barriers and convince them of the benefits of interventions like irrigation. Through investments in agricultural water management and innovative financing mechanisms, IFAD is developing distinct business cases for different farmer types in 6 African countries. In Ethiopia, for example we discovered that women preferred solar pumps that were located near the home, as these also reduced efforts on domestic chores. This finding informed the development of a business model for irrigation, making the case to farmers that solar-powered pumps would be an attractive investment, particularly for women.

Focusing on how to grow the Nexus as a framework is a critical next step, exploring current challenges and opportunities, as well as the role of the public and the private sector in the context of geopolitical and climate challenges that have profound implications for global supply chains and the associated impacts on water resources and food security, especially for the most vulnerable areas. In an age of climate change, rural prosperity and sustainable resource management can be a potent formula for peace the world over.

Urgent investments are clearly required globally, but few more so for the Near East and North Africa region, a key focus of IFAD's work in the nexus. Significant and bold investments to enhance water access and infrastructure, its management and governance, including modernizing irrigation systems, developing and maintaining rural water supply systems, promoting stakeholder participation in water governance, and investing in wastewater treatment plants and other water treatment technologies are required with IFAD financing geared towards providing that critical crowding-in effect, designing innovative blended finance mechanisms that can more effectively leverage the catalytic capital and crucially mainstreaming the Water Nexus approach with government partners.

## Urgent need for investments in the climate and water nexus in developing countries

In conclusion, IFAD's comprehensive approach to tackling the nexus of water, agriculture, and food security has shown promising progress, and significant efforts are underway to both raise awareness among the private sector by identifying key investment barriers in water projects, and potential policy changes and project structuring, financing, and delivery approaches, and the integration of climate and water into developing country partner Nationally Determined Contributions (NDC) targets and national investment planning.

The urgent need for investments should be recognized and addressed by global leaders to mitigate the unprecedented challenges and dire circumstances facing the world, including climate change, conflict, and global inflation, contributing to a food crisis of epic proportions.

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